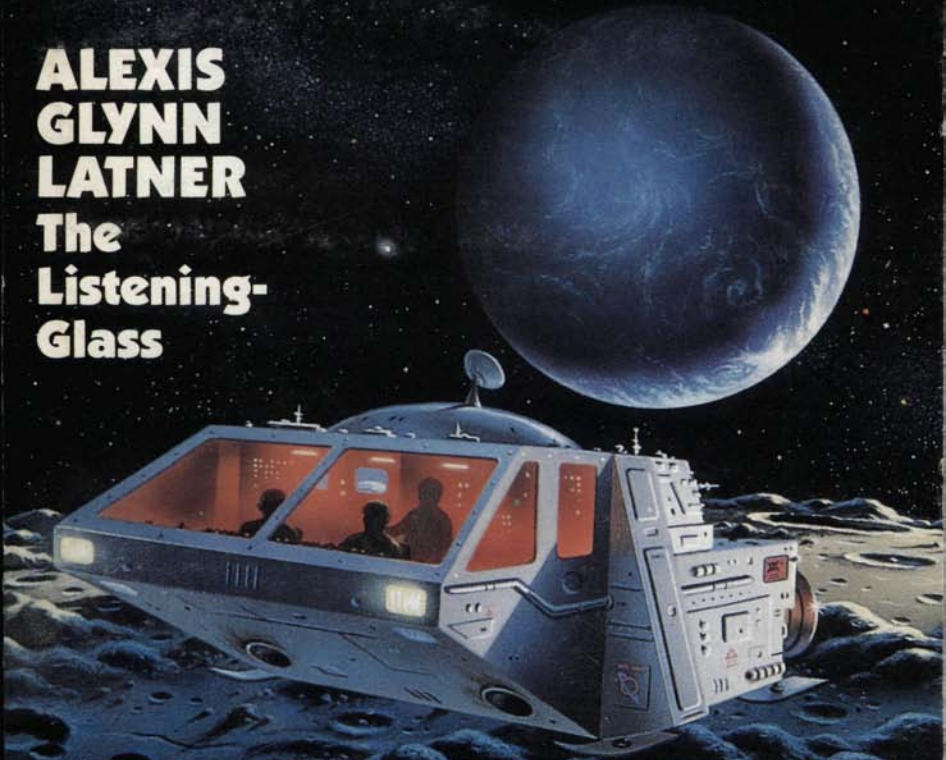
SINCE 1930 ASTOUNDING

February 1991 $2.50 U.S./$2.95 CAN.

SCIENCE FICTION analog SCIENCE FACT®



ALEXIS GLYNN LATNER
The Listening-Glass

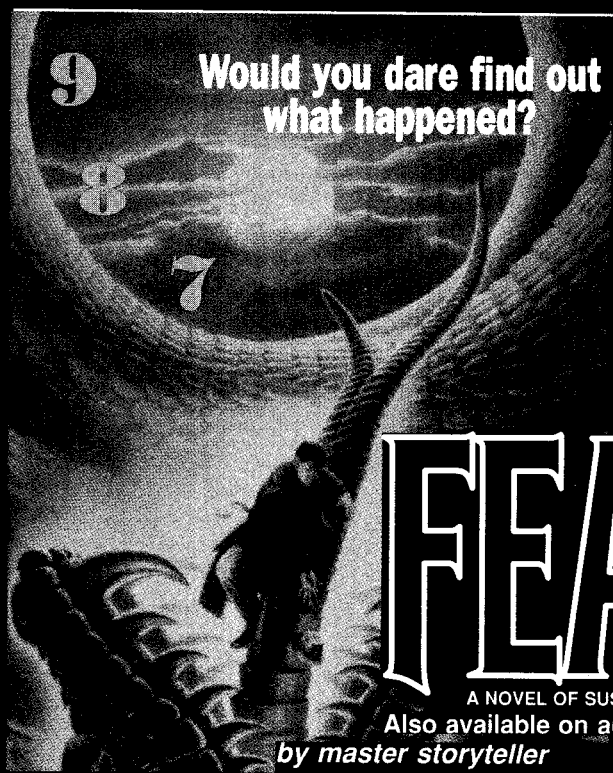
CHARLES V. De VET

MICHAEL F. FLYNN

02
36003
0 387168 3

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

What would you do if four hours of your life were suddenly missing?



FEAR

A NOVEL OF SUSPENSE

Also available on audio cassette

by master storyteller

L. RON HUBBARD

COMING IN JANUARY 1991

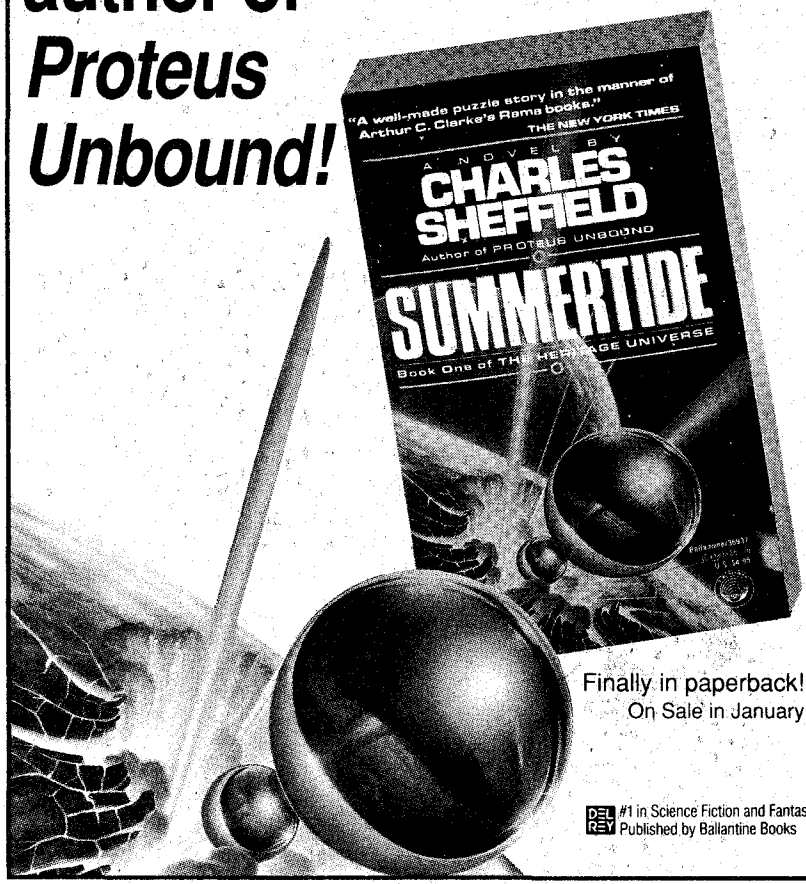
Copyright © 1990 Bridge Publications, Inc., All rights reserved.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

The acclaimed new adventure from the author of *Proteus Unbound!*

"A WELL-MADE PUZZLE STORY IN THE MANNER OF ARTHUR C. CLARKE'S *RAMA* BOOKS...I FOUND MYSELF GRIPPED."
—The New York Times Book Review

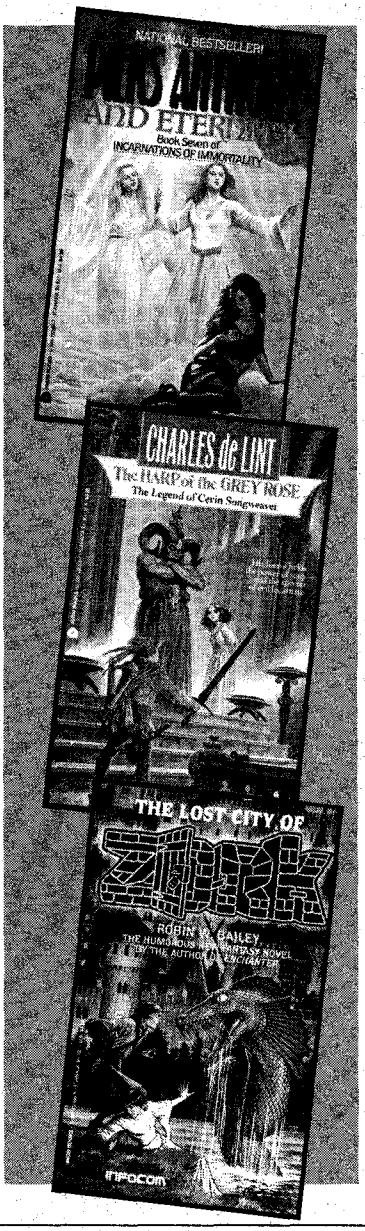
"THRILLING...IF ANYONE CAN DO A BETTER JOB, I'D LIKE TO KNOW ABOUT HIM."
—The Washington Post


"A well-made puzzle story in the manner of Arthur C. Clarke's Rama books."
THE NEW YORK TIMES
A NOVEL BY
CHARLES SHEFFIELD
Author of PROTEUS UNBOUND
SUMMERTIDE
Book One of THE HERITAGE UNIVERSE

Finally in paperback!
On Sale in January

DEL REY #1 in Science Fiction and Fantasy
Published by Ballantine Books

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



The Finest in Fantasy

AND ETERNITY
Piers Anthony

In the crowning achievement of *Incarnations of Immortality*, Piers Anthony weaves a playful, provocative, and stunning tale of morality, magic, and grand adventure.

"Rollicking, bawdy, and thought-provoking."
—Booklist

"Bright and breezy, sexy and fluffy."
—Kirkus Reviews

THE HARP OF THE GREY ROSE
Charles de Lint

Throughout the Celtic lands they would call him *Songweaver*. But for now, he was merely Cerin of Wran Cheaping—an orphaned lad of 17 raised by a wildland witch. And one day the boy will take on a man's challenge...and tread a treacherous path toward a magnificent destiny.

INFOCOM #6:
THE LOST CITY OF ZORK
Robin W. Bailey

The humorous new fantasy novel from the author of *Enchanter*.

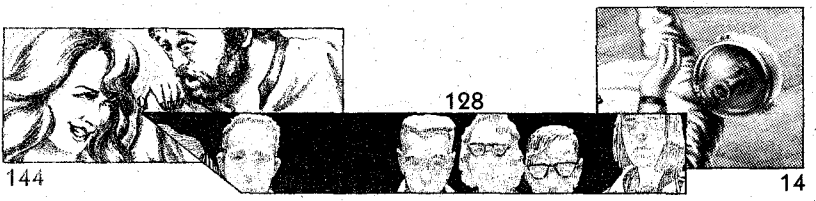
"Robin W. Bailey is an outstanding name in the field."
—Marion Zimmer Bradley

Coming in February 1991

AVON BOOKS
The Hearst Corporation

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

analog



Vol. CXI No. 3
February 1991

Next issue on sale
February 5, 1991

Novelettes

THE LISTENING-GLASS, Alexis Glynn Latner ____ 14
THIRD GAME, Charles V. De Vet ____ 54
MAGNOLIAS, MINT JULEPS, AND THE MOON, Grey Rollins ____ 144

Science Fact

HYDROGEN TIME, Marc Davenport ____ 87

Short Stories

THE BLOOD UPON THE ROSE, Michael F. Flynn ____ 48
HOBBITS, Maya Kaathryn Bohnhoff ____ 102
WHAT A PIECE OF WORK IS MAN, Edward M. Lerner ____ 111
CHILDHOOD ESCAPADE, Daniel Hatch ____ 128

Reader's Departments

THE EDITOR'S PAGE ____ 4
IN TIMES TO COME ____ 12
THE ALTERNATE VIEW, John G. Cramer ____ 122
THE REFERENCE LIBRARY, Tom Easton ____ 176
BRASS TACKS ____ 184
THE ANALOG CALENDAR OF UPCOMING EVENTS ____ 192

Cover by David A. Hardy

Joel Davis President — **A. Bruce Chatterton** Publisher

Stanley Schmidt Editor — **Tina Lee** Managing Editor — **Terri Czeczko** Art Director

Indicia on Page 6

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Editorial

SAY WHEN!

Stanley Schmidt

Life is full of situations in which most folks can agree, in a general way, that something needs to be done, but before it *can* be, somebody has to make a decision about how much and when. When a beer glass is being filled, sooner or later the bartender must stop pouring. He may decide for himself when to do that, or he may ask the customer to, "Say when!" Either way, it's no big deal. It's just a glass of beer, most customers aren't all that particular, and if one is, the bartender will probably figure, "The customer is always right."

But when the glass is very large, being filled with something a lot more important than beer, and a great many people have strong opinions about how the job should be done . . .

Getting them to agree may be very difficult indeed—so difficult, in fact, that before anything is done, the whole joint is awash in metaphorical beer. Which can get messy, to say nothing of dangerous.

Case in point: population. It's not too hard to get most halfway reasonable people to agree, in principle, that any given finite resource base can support only so large a population. You can even get a good many of them to agree, in principle, that if a population is approaching the limits of what its environment can support, something should be done to control its continued growth.

Getting them to agree on *when* that point has been reached, and just how much of what kind of action should be taken, is *enormously* more difficult. A large part of the problem, aside from just plain short-sightedness, is that people don't agree on what "support" means in this context—and they probably never will, because the answer is partly a matter of personal taste. Some may acknowledge that overpopulation *could* become a problem, but quite sin-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

cerely believe that the problem lies so far ahead that *they* don't need to think about it. Others may just as sincerely believe that the critical point has long since been passed, and drastic corrective measures need to be taken immediately.

Some months back, I commented in these pages on the short-sightedness of arguing about the relative merits of paper and plastic disposable garbage bags when the *real* choice is between disposable and reusable. One reader who had obviously done a good deal of thinking about the big picture wrote in to complain that even talking about that question, or any of many other fashionable "ecological" ones, is short-sighted in that it deals only with a symptom, not the underlying disease. He pointed out, quite correctly, that all our problems of pollution, famine, resource depletion, accelerating greenhouse effect, and so on, are merely consequences of the fact that people have become very numerous and their combined impact on the environment is far greater than it was when there were fewer of us. In his opinion, population has already exceeded the carrying capacity of the planet, and the only real solution is "drastic depopulation."

At the other extreme are people who consider even mild attempts at control of further population growth, much less any talk of reducing existing population, taboo and unthinkable. They favor allowing, or even encouraging, everyone everywhere to have as many children as they want. A sizable subset of them are actively trying to put an end to most, or even all, abortions. A smaller subset goes even further and would like to ban all forms of contraception. Some of these show at least a dim awareness (but seldom much more) that achieving these goals would result in even faster population growth than we're already experiencing. They propose to offset that growth by having everybody consume less and recycle more. They would like to see everyone adopt, voluntarily or otherwise, tactics like carpooling, shower flow restrictors, vegetarianism, and putting up with more thermal discomfort to conserve fuel used for heating and air conditioning. Some of the more visionary figure that population growth won't really be a problem, at least for a long time, because space colonies will be able to absorb the excess produced on Earth.

All of which sounds very nice and noble, but unfortunately none of it does more than buy a little time. Such measures may postpone the next decision about what to do, but they cannot do more than that. As the "drastic depopulation" advocate (let's call him "Mr. D.D.") says, such actions attack symptoms, not the disease.

This is not to say that they are wrong, or bad things to do; they simply aren't enough. If he thinks about it, I suspect that even Mr. D.D. will recognize that symptoms often need to be treated even while the causes of a disease are being attacked. Acute appendicitis is *cured* by removing the diseased appendix—but I'll bet even Mr. D.D. would insist on anesthesia during the operation, and strong painkillers before and after.

In the population analog, he wants

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the operation right away, but doesn't want to help administer the painkiller—because he personally doesn't expect to need any. He's *got* his, and to hell with everybody else! He boasts that he hasn't contributed to the overpopulation problem, and therefore he has no intention of lifting a finger to do anything about any of the resulting secondary problems. He will *not* take a shopping bag to market, or ride a bicycle in bad weather or public transportation even in good, or go without water in a restaurant. He *will* keep his swimming pool comfortably heated yearround, run his laundry through extra rinse cycles, collect ivory, and drive his car with the windows or top down and the air conditioning on. (Please don't ask me to explain why anybody would even want to do such a ridiculously inconsistent thing as that last one. I haven't the foggiest.) After all, he says, none of the things he plans to keep doing would be a problem, and none of the ones he refuses to do would even need

STANLEY SCHMIDT ..... Editor
TINA LEE ..... Managing Editor
IAN RANDAL STROCK ..... Assistant Editor
SCOTT L. TOWNER ..... Editorial Assistant
A. BRUCE CHATTERTON ..... Publisher
TERRI CZECZKO ..... Art Director
ANTHONY BARI ..... Junior Designer
CAROLE DIXON ..... Production Director
CYNTHIA MANSON ..... Director of Marketing and Subsidiary Rights
CONSTANCE SCARBOROUGH .. Contracts Manager
VEENA RAGHAVAN ..... Director, Special Projects
CHRISTIAN DORBANDT ..... Newsstand Marketing and Promotion Manager
DENNIS JONES ..... Newsstand Operations Manager
ELIZABETH BEATTY ..... Circulation Director
JUDY DORMAN ..... Advertising Coordinator
IRENE BOZOKI ..... Classified Advertising Manager

Published since 1930

JOEL DAVIS
President

CARL BARTEE
Vice President
Manufacturing

JOE DeFALCO
Vice President
Finance

MARY TZIMOKAS
Vice President
Circulation

First issue of *Astounding*
January 1930

ADVERTISING OFFICES
NEW YORK
(212) 557-9100

Analog Science Fiction/Science Fact (Astounding) is published every 28 days with special issues in January and July by Davis Publications, Inc. at $2.50 a copy in U.S.A., $2.95 in Canada. 1 year subscription for $34.95 in the U.S.A. and possessions, in all other countries, $39.65 payable in advance in U.S. funds. First copy of new subscription will be mailed within eight weeks of receipt of order. When reporting change of address allow 6 to 8 weeks and give new address as well as the old address as it appears on the last label. Second-class postage paid at New York, NY, and at additional mailing office. Canadian 3rd class postage paid at Windsor, Ontario. © 1990 by Davis Publications, Inc., all rights reserved. Protection secured under the Universal Copyright Convention. Reproduction or use of editorial or pictorial content in any manner without express permission is prohibited. All stories in this magazine are fiction. No actual persons are designated by name or character. Any similarity is coincidental. Printed in U.S.A. All submissions must be accompanied by stamped self-addressed envelope, the publisher assumes no responsibility for unsolicited manuscripts or artwork.

POSTMASTER: SEND to ANALOG SCIENCE FICTION/SCIENCE FACT (ASTOUNDING) P.O. BOX 7061, Red Oak, IA 51591. IN CANADA RETURN TO 1801 SOUTH CAMERON, WINDSOR, ONT. CANADA N9B 3E1
Editorial and Advertising: Analog Science Fiction/Science Fact, 380 Lexington Avenue, New York, NY 10168-0035
Subscriptions: Analog Science Fiction/Science Fact, P.O. Box 7061, Red Oak, IA 51591.ISSN 0161-2328

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Send for FREE FACTS

Train at home for a better career
49 ways ICS can help improve your life

Get Your Specialized Associate Degree or Career Diploma at Home in Spare Time

The decision to invest time, energy and money in preparing for a new career is not an easy one. Yet it may be the most important decision you will ever make. It can offer you the opportunity to qualify for the job you want...more money, more prestige, a better way of life.

At ICS we've spent more than one hundred years training people for exciting, profitable careers. Since 1890 more than 10,000,000 students have enrolled with us and over 2,000 major corporations have chosen the ICS training system for their own employees!

No Need to Attend Technical School, College or University

If you've always wanted your Specialized Associate Degree, now you can get it without ever setting foot on a college campus! Or if specialized career training is your goal, now you can have that, too...no need to attend trade or technical school. Home study makes it possible to get the education you want, yet never quit your job or change your lifestyle. You study at home, the hours you choose...go as fast or slow as you like.

And our lessons make it easy because they're clearly written and include drawings, diagrams and photos. Tools, calculators, electronic instruments, computers, drawing materials, fabric swatches, reference books... whatever you need to complete your training is included with your program at no extra cost!

CALL TOLL FREE

1-800-228-5300 Dept. ADRS11S

CALL ANYTIME—Operators to take your call 24 hours a day, 7 days a week.

OR MAIL COUPON TODAY.

ICS SINCE 1890 Over 100 Years of Excellence

International Correspondence Schools, Dept. ADRS11S
925 Oak Street, Scranton, Pennsylvania 18515

Please send me free facts, color brochure and full information on how I can train at home for the career I have chosen. I understand I am under no obligation and no salesman will visit me. **CHECK ONE BOX ONLY.**

ASSOCIATE IN SPECIALIZED BUSINESS DEGREE PROGRAMS
- ☐ Business Management
- ☐ Accounting
- ☐ Business Management with option in Finance
- ☐ Business Management with option in Marketing
- ☐ Applied Computer Science
- ☐ Hospitality Management

ASSOCIATE IN SPECIALIZED TECHNOLOGY DEGREE PROGRAMS
- ☐ Civil Engineering Technology
- ☐ Mechanical Engineering Technology
- ☐ Electrical Engineering Technology
- ☐ Industrial Engineering Technology
- ☐ Electronics Technology

8282C

CAREER DIPLOMA PROGRAMS
- ☐ Computer Programming
- ☐ Computer Programming/COBOL
- ☐ Personal Computer Specialist
- ☐ Computer-Assisted Bookkeeping
- ☐ High School
- ☐ Catering/Gourmet Cooking
- ☐ Medical/Dental Office Assistant
- ☐ Microcomputer Repair
- ☐ Auto Mechanics
- ☐ Bookkeeping
- ☐ Hotel/Restaurant Mgmt.
- ☐ Drafting
- ☐ Animal Care Specialist
- ☐ Travel Agent
- ☐ Air Conditioning & Refrigeration
- ☐ Electronics
- ☐ Secretary
- ☐ Electrician
- ☐ Police Sciences
- ☐ Private Security Officer
- ☐ Art
- ☐ Small Business Mgmt.
- ☐ Interior Decorating
- ☐ TV/VCR Repair
- ☐ Child Day Care
- ☐ Wildlife/Forestry Conservation
- ☐ Legal Secretary
- ☐ Diesel Mechanics
- ☐ Fashion Merchandising
- ☐ Gun Repair
- ☐ Motorcycle Repair
- ☐ Surveying & Mapping
- ☐ Fitness & Nutrition
- ☐ Legal Assistant
- ☐ Photography
- ☐ Journalism/Short Story Writing
- ☐ Dressmaking & Design
- ☐ Starting Your Own Business

NAME_____ AGE_____

ADDRESS_____ APT. #_____

CITY/STATE_____ ZIP_____

PHONE ( )_____

A Subsidiary of National Education Corporation

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

to be considered, if there weren't so many people. Therefore he wants, among other things, to require sterilization of groups ranging from welfare mothers to politicians, and to cut off all aid to underdeveloped countries and disaster victims, to encourage natural trends to decrease the surplus population. (Hmm-m-m . . . maybe a better pseudonym for him would be "Mr. E.S. . . .")

I suspect (and hope) that most readers will consider this an extreme position—but so is the "let's all reproduce as fast as we can" school. Space colonies will *not* be able to absorb the excess population produced on Earth; no reasonably foreseeable transportation system could move them out anywhere near as fast as they're produced, and in any case space colonies will tend to fill themselves from inside, just as Earth does. Improving technology and/or lowering standard of living can increase the carrying capacity of any habitat, up to a point—but not without limit. Sooner or later, the population of *any* finite space will have to be controlled. If the people don't do it themselves, nature will do it for them—but they're not likely to like her methods, which routinely include famines, plagues, and extinctions. So they'd be well advised to find better ways for themselves, before that happens.

Which brings us back to the basic question of the day: precisely what should be done, when, and how much? That, I fear, is the sticking point that is likely to keep much of anything from being done soon enough.

The question of "What is an acceptable population?" is not a simple one. It has lots of corollaries, like "What is an acceptable standard of living?" And people do *not* agree on an answer to that. The most extreme proponents of unlimited population growth figure we should all be willing to sacrifice a great deal to make room for more of us. The most extreme advocates of unlimited personal consumption (most of whom, like Mr. D.D./E.S., are already comfortably practicing it) maintain that those who are not personally contributing to the population explosion have no obligation to sacrifice anything at all. (Never mind the logical inconsistency between this view and the fact that if lots of people practice what Mr. D.D. preaches, they all hurt each other. . . .)

Distasteful as some details of his prescription for action may be to many (including me), Mr. D.D. does make at least two valid and important points. First, population is the issue at the heart of all other environmental problems, and any truly effective, long-term solution has to address that root cause as well as symptoms. Second, many individual actions which are now perceived as "environmental abuses" would be quite harmless if there weren't so many people doing them—and people who have experienced these "luxuries" are not about to give them up lightly.

Nor should they be expected to. The fruits of technology use energy and materials to make life much more comfortable, enjoyable, and otherwise rewarding for those who use them. Why *should* anybody who has learned that through firsthand experience willingly

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

N E W S F R O M

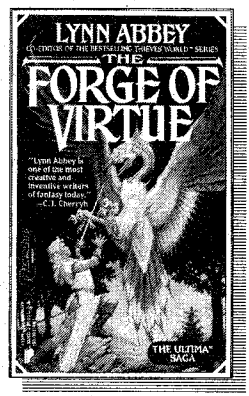
Questar
SCIENCE FICTION / FANTASY

By the bestselling co-creator of *Thieves'World*—

A WONDROUS LAND, FOUR YOUNG ADVENTURERS AND A QUEST OF A LIFETIME!

In the bestselling tradition of the DragonLance® novels, here is thrilling sword-and-sorcery based on the Ultima™ role-playing computer games.

Brittania. A place where magic is science and evil a fading memory. A society of universal enlightenment now so close to perfection that both its creator and heroic Avator believe it can be safe without them. Out of this land come four brave comrades heeding a mystic globe's dark warning to find the mysterious wizard Balthan. It is an adventure that will take them through the perils of trolls, harpies, and gypsies until they discover the mission is far more crucial than they ever imagined. And only the elusive Balthan knows the truth behind it all...


LYNN ABBEY
co-creator of the bestselling "Thieves' World" series
THE
FORGE OF VIRTUE
"Lynn Abbey is one of the most creative and inventive writers of fantasy today."
—C.J. Cherryh
THE ULTIMA SAGA

"Lynn Abbey is one of the most creative and inventive writers of fantasy today."
---- C.J. Cherryh

0-445-21065-6/$4.50
(In Canada: $5.95)

A WORD FROM BRIAN THOMSEN

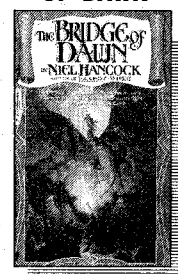
1990 has drawn to a close and in retrospect, I can safely say that it was a good year. There were thought-provoking new books by Greg Bear, Michael Armstrong, and Robert Silverberg, as well as first-rate entertainment from all QUESTAR authors.

Sure, there were more taxes, earthquakes, and crime, and more than a few doom-sayers predicting the end of the world ... but remember we are now living in yesterday's future. We have survived another year, and I for one am looking forward to 1991.

My resolution, of course, is to deliver more topnotch QUESTAR books to you in the next year (but I'm being redundant—every QUESTAR book is topnotch!).

ALSO THIS MONTH:

THE BRIDGE OF DAWN



The triumphant finale of *The Windameir Circle* by Niel Hancock, author of the bestselling *Circle of Light* series.

From water, sky, land and even from beneath the earth—the ragged-taggle Champions of Light race to wrest besieged Eirn Bol from the Dark One's evil firesnakes and BlackHoods. Now Owen Helwin, bearing the majestic Sword of Skye, must gather the great beasts around him. For only their strength can help him win the ultimate battle at the mystic Bridge of Dawn.

Cover art by Tim Hildebrandt
0-445-20824-4/$4.95
(In Canada: $5.95)

Also read:
The Sea of Silence
0-445-20565-2/$3.50
(In Canada: $4.50)
A Wanderer's Return
0-445-20822-8/$3.95
(In Canada: $4.95)

© 1990 Questar Library Printed in USA

AVAILABLE AT BOOKSTORES EVERYWHERE POPULAR LIBRARY

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

return to a miserable, hand-to-mouth way of life? I realize that it's currently fashionable to react to such a statement with a reflexive cry of, "Materialism!," and I agree that materialism *by itself* does not constitute a sound set of values. But there's no reason to be ashamed or apologetic about having a set of values that *includes* the desire for a certain amount of material comfort as one of its components. We are, after all, creatures at least partly of matter and energy—and it's a lot easier to concentrate on higher values of the sorts some call spiritual when you're not having to devote your whole being to wondering when your next meal might be.

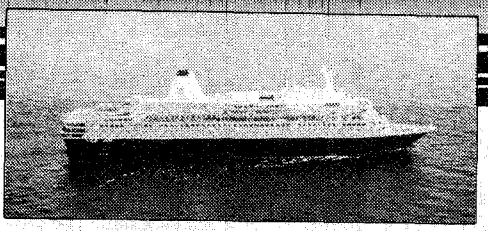
So—what *should* the population of this planet be, how do we get there from here, and what should we do while we're working on it? My own current inclinations lie somewhere afield of either of the two extremes I've described. I certainly don't believe that what the world needs more than anything else is as many people as we can possibly cram onto it; and I'm not willing to give up, to make that possible, the benefits of civilization that my ancestors and I have earned. At the same time, I cannot say as casually as Mr. D.D. that we should do everything we can to encourage less fortunate fellow humans to die off to make it easier for the rest of us to live high on the hog. I see a fundamental difference in the morality of dealing with people who already exist and those who don't and don't have to.

We do not owe the latter anything; therefore I have no qualms about saying that birth rates need to come down. At the very least, it seems to me, the populaton needs to be stabilized; reduction would be better, and may be necessary. I don't believe that present technology, or that foreseeable in the near future, can support a population as large as we now have at anything like the standard of living the so-called "developed" countries now have. Nor do I believe that lowering their standard of living to that of the "undeveloped" countries would constitute progress. What *would* be progress is spreading a higher standard of living to more of the population—but that can probably only be done if the population becomes smaller.

How is that to happen? It won't be easy, but I don't think it requires the inhumane extremes proposed by Mr. D.D. It could happen, for example, by a gradual process of attrition—by letting people now alive live out their natural lives, while reducing the number of new ones being born. That last will be especially difficult, because the developing countries are where the most change is needed in that respect; and any time you talk about selectively reducing the birth rate in some geographic areas you will be confronted with violent shouts of, "Genocide!" But you must not be intimidated by the word, for it is being misused. What I am talking about is *not* by any means genocide, and somehow you will have to find ways to make people understand that and see why they need to do what they need to do.

It won't be easy, but it has to be done. If there are so many of us that our numbers, together with our wasteful and

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



FOR A CRUISE VACATION THAT WILL BE "OUT OF THIS WORLD"

Don't Miss Davis Publications'

SCIENCE FICTION CRUISE '91

Sailing To The Beautiful Eastern Caribbean
From Ft. Lauderdale, Florida
OCTOBER 19, 1991
Aboard Holland America Line's Fabulous Luxury Liner
M.S. WESTERDAM

Join top writer JOE HALDEMAN and Writer and Editor STANLEY SCHMIDT for seven fun-filled days aboard one of the universe's great cruise ships sailing to some of our world's great Ports-Of-Call: San Juan, Puerto Rico; Virgin Gorda, B.V.I.; Tortola, B.V.I.; St. Thomas, U.S. Virgin Islands; and Nassau, Bahamas.

Enjoy the best that luxury cruising offers PLUS lots of special SCIENCE FICTION CRUISE events including: Private Sessions With our Experts, Open Bar Cocktail Parties, Trivia Contests, Special Gifts, and LOTS of Surprises! Create new worlds with Mr. Haldeman and Mr. Schmidt as they guide you through an imaginative story telling adventure! Prices for SCIENCE FICTION CRUISE '91 include round-trip air fare and start at only $1209 per person, double occupancy from most major cities. There is limited availability in some cabin categories. First come, first served.

BOOK EARLY.....SPACE IS LIMITED.....PAYMENT PLAN IS AVAILABLE

To be part of this fabulous week and to receive all the special amenities, you *must* book your cruise with:

OMNI GROUP CRUISES, INC.
6513 Hollywood Blvd. Ste. 205, Hollywood, CA 90028
Write or call for information
(800) 876-OMNI or (213) 467-6313

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

messy habits, endanger all of us, then all of us are going to have to do something to reduce that danger, both for the others already here and for ourselves. All of us—even Mr. D.D., no matter how blameless he may consider himself.

Helping fellow human beings to survive famines and floods, and to make their lives a little less miserable, remains a decent and desirable thing to do, even if the present population is larger than ideal. But even as we do that, we shall still have to do something about the basic problem. What we do can include controlling population, finding cleaner and more efficient ways to achieve the benefits of civilization, or settling for fewer of those benefits.

Deciding how much of which of those tactics should be used involves a fundamental trade-off which will remain a source of heated controversy throughout the foreseeable future. Surely the first will be necessary, in some form, but how much and what form will depend on choices made about the other two. Some consider any form of population control a last resort, if they grant it even that; others are extremely reluctant to forego any of the comforts of civilization. Establishing priorities for real-world action will remain a nasty bone of contention, but neither it nor the need to confront it can be wished away. ■

IN TIMES TO COME

● Among people who have noticed the less beneficial effects of human habitation on the biosphere, an ideal has grown up of "working *with* nature, not against it." Sounds good, but just how feasible is it? On Earth, it's hard to tell; human impact has been around so long, and evolved so gradually, that most people would be hard put to imagine what the biosphere would be like without it. Colonists on a new planet might have a better chance to find out. Suppose they settle in with the best intentions of having minimal impact on the established ecosystem; try as they might, they'll have to deal with the fact that that ecosystem simply does not have a niche evolved for them. Which will lead to problems like those in Daniel Hatch's "Den of Sorrow," next month's cover novelette (and a part of his ongoing series about the colonization of Asgard).

Our March issue will also offer a variety of other fiction by writers including Lawrence Watt-Evans and F. M. Busby, and a fact article by Dr. Gay E. Canough and Dr. Lawrence E. Lehman about trash—specifically, how to deal with the growing problem of discarded clutter in space. It turns out that at least one possible solution is something you've heard a lot about, in a completely different context. . . .

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

THE CAT'S OPINION

by Marianne J. Dyson

An alien yellow with silicone slime
Attempts the deal of a human lifetime:

In trade for one said calico cat
An FTL drive, imagine that!
With such a secret, his one eye beams
You can conquer the beasts of dreams
No virgin planet left unchurned
No jungle forest left unburned
The Universe is yours, he maws,
The calico cat unsheaths her claws.
I let her go, this skeptical one,
With hisses and bites—the deal is done.

I must do without the FTL,
For I trust feline judgment well.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Some things won't wait—
so sometimes it's more
important to get things *done*
than to do them in
the best of all
possible ways.

THE LISTENING-GLASS

Alexis Glynn Latner

David Hardy

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Acrophobia. It always hit him here, midway on the catwalk. He let his gloves slide along the guidewires. Within the bulky gloves his palms sweated profusely. Ahead of him and even higher up, the catwalk ended at the antenna suspended on the convergence of three sets of immensely long cables. There was nothing under the antenna. Nothing. Hard vacuum, underlined with a thin, curved shell of material that gleamed coldly in the downward periphery of his vision. He dared not look down. If he did he would freeze.

The antenna's present position left too much slack in the catwalk for his liking. Every step caused a ripple to propagate up the catwalk ahead of his boots. In the confines of his suit helmet, his breathing sounded too quick and ragged. He tore his eyes away from the alarming frailty of the catwalk and fixed them on the motionless horizon, the tangle of crater rims on the dark gray edge of the world. The horizon reminded him that this was the Moon. It had only one-sixth of the gravity of Earth. Fact: the catwalk was rated to carry twice the mass represented by himself plus spacesuit. Doggedly, he kept going.

The antenna resembled a large leggy spider, hanging upside down on flimsy strands of web. Appearances were deceiving on the Moon. The cables could easily support the antenna plus a work crew in spacesuits; had done so during the construction phase. Making the structure sturdy enough for Earth gravity would have been over-designing to a ludicrous extent. Nevertheless, he was acutely aware of the vertical vacuum under the antenna, exceeding the height of the towering rocket that brought the first men to the Moon more than four decades ago. He made a quick and rather morbid mental calculation. You could stack one and a half Saturn Fives under the antenna.

His mouth felt very dry. And he detested the scratchy inorganic tang on his tongue. He could taste the gray indifference of this world. The acrophobia had never been this bad before. But then he'd never gone up to the antenna alone. At night. Stars, unsympathetic, icily burning, filled the black sky. Starlight thousands of years old rained down, and it pooled far below his feet. He resisted the urge to look down into the vast, cold, mesmerizing shimmer of it. People could freeze up here, in such a paralytic state of fright that somebody had to come up and retrieve them. He could, and probably should, turn around, go back to the habitat, and not mention this abortive excursion. No. Take another step, another, another: he was not going to let the acrophobia get to him.

This trip up to the antenna seemed to be taking a lifetime, as if the catwalk were as long as his life span. In a way, it was.

The catwalk began in the fifth grade, to be exact, with a report card—a D in science. Bright and bored in classes taught by mediocre teachers to pupils of average intelligence, he had been indifferent to grades. But the D stung. The class started an astronomy unit. Reports were assigned, prepared, presented. The others read silly little pages about The Moon or The Planet Jupiter — childish, inept transcriptions from the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

encyclopedia. But he really researched his topic, at the public library. In front of the class, he drew a line down the whole length of the chalkboard to represent the electromagnetic spectrum; he showed them the small fraction of the spectrum taken up by visible light, and the far greater span of radio. He explained how radio telescopes revealed the invisible mysteries of the Universe. He showed them. The next report card featured an A-plus in science. And he had done astronomy ever since, from the backyard telescope to the vast machine on which he treaded now.

He checked his position. Fifty feet from where the catwalk ended at the antenna. The antenna was mobile within a volume of space of some hundreds of cubic meters. And when it moved, the end of the catwalk moved with it. Of course he had put the safety switch on. *Hadn't he?* He should not have thought about that. He froze. The moonsuit had a radio. Maybe he should tell someone what he was up to. His throat constricted. He felt his motor muscles congealing too.

With an angry act of will, he started going again. He reached the antenna platform.

Then he let it happen, impulsively looked down, through the grate of the platform floor, and past the wide wheel with the azimuth arm hanging on it; down, into the crater full of radio telescope. The edge of it marked an immense circle like an inverse horizon. Triumphant and vertiginous, he clung to the platform's guard rail. The last steps were the hardest. It was just that simple.

There had been dreary years of delay, constipation of funds, and design compromise. And then the last and hardest part. Construction. The fact that the site was on the far side of the Moon had amplified every difficulty, every mistake, by at least an order of magnitude. But now it was finished, real, and ready to be tested, first thing tomorrow. He had come up here tonight to make sure that one last detail was put right before the big day. As a manager, people said, he was too detail-oriented.

In the center of the platform stood a dog-house sized metal box that housed the equipment, which contained the detail that he was after. Making himself let go of the rail, he strode toward the housing. There was nothing to hold onto between the guardrail and the equipment housing.

Then he noticed the lights on the corners of the platform. They flashed a red warning strobe. *The antenna was being repositioned.* Shocked, he stared. It wasn't supposed to happen with someone up here! But the structure slewed under his feet. He made a panic lunge, launched himself toward the equipment housing.

Colliding with the housing, he failed to secure a handhold on the slick box, and ricocheted off. The platform dropped underneath him. He could not find stopping traction as he skidded toward the far edge of the platform. Desperately he grabbed at the guardrail, with the full force of his Earth-powered muscles misdirected. He reached too high and jackknifed over the rail. He flailed. Then he started falling.

The azimuth arm wheeled around. It went by at the limits of his desperate reach; his glove brushed the metal

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

frame. The arm moved away. He tumbled. Across his sight swung the azimuth arm's wheel, stars, the silver chasm of dish.

He fell slowly and realized it. A hammer and a feather have the same acceleration on the Moon and so does a man falling to his death. He had time to think. Not necessarily death. If the dish stopped him cold, it would definitely kill him. If the dish broke instantly, it would barely slow him down, and hitting the crater floor would kill him. But if the dish broke *slowly* it might actually break his fall.

The sides of the dish rose up with the ominous leisure of a mounting tidal wave. Just before the wave broke, he tried to fold the bulky spacesuit, cannonball, as though he were falling into a net.

His swaddled shoulder took the impact. The shocked dish gave way, slowly. Then it tore, letting him drop to the crater floor. He hit the floor bone-bruisingly hard, bounced, and finally sprawled on his back.

To his surprise, he was not dead. But he had the wind knocked out of him. He gasped for air. From the jagged hole in the dish above him, fragments drifted down, tumbling. He couldn't breathe. Darkness with red veins closed in on him. Faintly he heard a clamor in his suit radio. "*John! John!!*" Somebody sounded hysterical. He tried to answer. All he could get out was a broken wheeze.

The ongoing clamor in his ears bothered John. Garbled words. Verbal static. Finally, something intelligible. "ETA twenty minutes. Keep the victim immobile."

"Roger, Hadley, hurry!"

He took inventory of his body. Dull pain here and there. He rolled over with a pained grunt.

A young man jumped in front of John and he recognized Edward, the computer engineer. Edward waved his hands. "Don't move!"

There was a woman whirling away from the radio station where she had been standing. He knew her, too. Jennifer said, "Good Lord!"

"Good morning," he said thickly. "Tell 'em to turn back. I'm all right." With an effort, John sat up.

Edward pleaded, "Please don't move!"

John tried an exaggerated shrug, then rolled his head. Didn't feel too bad, considering. If this had been Earth and Earth's weighty gravity, he probably would have been flat on his back groaning, down for the count. No. If this had been Earth he would have been dead.

Jennifer hurried over. "Lie back down! You're hurt even if you don't have enough sense to know it!"

"I want to know who moved the antenna," he said.

"I'm terribly sorry!" Edward blurted. "Your colleague sent a message saying that it was very important to look at the supernova right away without even waiting for tomorrow morning, so I entered the coordinates. I didn't know you were up there!!"

"What colleague?"

"Baltazar," said Jennifer. "Just what were you doing up there?"

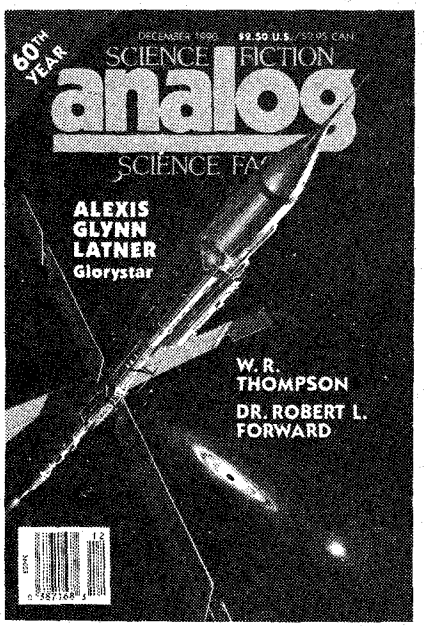
"What supernova?" John asked.

"You forgot to put the safety on."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

THE PAST, THE PRESENT, THE FUTURE, THE UNKNOWN.

SUBSCRIBE NOW AND SAVE 29% OFF THE BASIC PRICE
CALL TOLL-FREE 1-800-333-4561



YES SEND ME

☐ Please send me 18 issues for only $29.50 —save 29% off the basic price.

☐ Please send me 12 issues for only $19.97.

SCIENCE FICTION analog SCIENCE FACT®

Mail to: P.O. Box 7060, Red Oak, Iowa 51591

Name_____

Address_____

City_____

State_____ Zip_____

Please allow 6-8 weeks for delivery of first issue. *Outside US & Poss. 12 for $25.97, 18 for $38.75.*
All foreign orders must be paid in advance in U.S. currency.

HTSC-8

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

John frowned. "I put it on."

"The antenna won't move with the safety on."

"*I put it on!* Edward, check the safety switch!"

"Yes sir." Edward scuttled to the control panel. He called back, "It's on!" A very young, very honest man, he went on to say. "This is my fault too—I never once thought to test the safety switch circuit!"

"Not your job," John said.

"Oh, but I should have—"

"No, not you." Jennifer shook her head. "So it's faulty. What a way to find out."

Vindicated, John swung his feet around. They had deposited him on the overnight cot here in the control room. His moonsuit lay in the corner, sadly dirty and disassembled. Jennifer's assistant crouched there, staring at the suit, thinking in Chinese, but the drift of his thoughts was easy to guess. Scuffs and scrapes marred the moonsuit's outer fabric. The cranium of the helmet had a terrible dent in it. John felt a strange internal quiver that must have been a shudder. Anxiously he inventoried his body once more. All dull pains, except a tiny sharp one needling the base of his head. "I'm OK," he said shakily. "You can all go to bed or whatever."

"Not after having the living daylights scared out of us like this!" Jen retorted, and she added, "this isn't some hotel to go sauntering around alone at night, you old fool!"

That wasn't fair. He hadn't been sauntering. And she had as many gray hairs as he did.

She refused to tell the medical rescue team from Hadley Base to turn back.

The team, two men, thundered in through the airlock with a medivac cocoon, ready to stuff an unconscious victim into it and bundle him away. John pointed out that he could move all of his limbs and digits and felt basically intact.

The doctor, with the red cross on the arm of his coverall, frowned. "Internal injuries are very deceptive under conditions of low gravity. You need to be examined in the hospital."

"Take him!" Jennifer said emphatically.

At least they let him sit up, belted into a cramped seat behind the pilot. Moondust sprayed past the porthole at his shoulder as the moonhopper took off. The dust cleared as the hopper gained altitude. Then he could see Sand Lake with its rim wall around a wide pale plain. There lay a patch of silver threads, an incongruous cross-stitch on the hoop of lunar plain: the Lunar Far-Side Very Low Frequency Array, LFSVLFA, Jennifer's project.

The hopper looped around to its intended course. John glimpsed the radio dish, filling the crater Bolton on the edge of Sand Lake. He ought to have been inspecting the damage instead of going to the hospital at Hadley.

Sure he was sick. Sick of Sand Lake, sick of the hardscrabble living conditions here. Sick of the Bolton dish. It had been a mistake on his part to move up into management. A big mistake to take over the project manager's job when Phil Taylor was disqualified by a heart condition. If it had been Phil today, taking that heart-stopping fall, the hopper would be ferrying a corpse back to Hadley.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

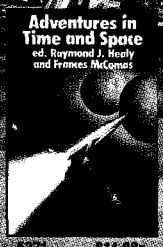
Come look at Earth... through Martian eyes.

Thirty years ago it was published—so far off the beaten path that its editors made Robert A. Heinlein cut over 50,000 words.

Now—for the first time—the original *uncut* version of *Stranger in a Strange Land* has been published. We think you'll enjoy this freewheeling look at our culture.

It's the kind of story you'll always find when you belong to *The Science Fiction Book Club*!

Get this book FREE plus 4 for $1 with membership

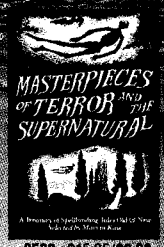


5371 $14.98x

6676 $19.95/$9.98

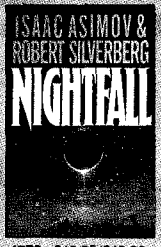
4804 $5.98x

6650 $18.95/$9.98



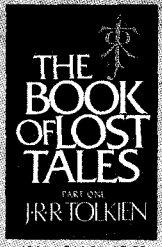
3533 $15.95/$6.98

4855 $18.95/$8.98



4770 $19.95/$10.98

4820 $18.95/$8.98



1362 $14.95/$6.98

3996 $18.95/$9.98

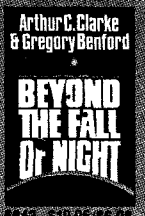
THE Science Fiction BOOK CLUB®

Reading That's Worlds Apart

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

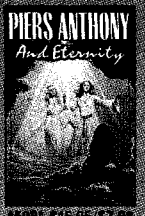
Continue to save on hundreds of books —as much as 65% off publishers' prices!

0208+ $18.95/$8.98



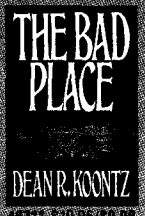
0643 $19.95/$6.98

0125 $19.95/$6.99



4598* $16.95/$7.98

0364 $19.95/$9.98



4671* $19.95/$9.98

5413 $6.98x

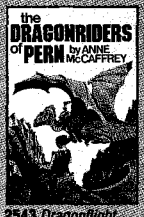
2687 $16.95/$8.98

4531 $17.95/$8.98

0153 $19.95/$8.98

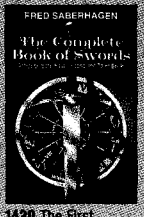
0634* $6.98x

0034 $6.98x

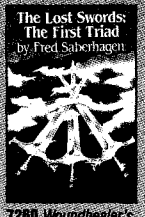


2543 *Dragonflight, Dragonquest, The White Dragon* $26.85●/**$10.98**

4440 $19.95/**$10.98**



1420 The First, Second and Third Books **$9.98x**



7260 *Woundhealer's Story, Sightblinder's Story, Stonecutter's Story* $45.85●/**$8.98**

4663* *Hyperion, The Fall of Hyperion* $38.90●/**$13.98**

4747 *So You Want To Be a Wizard, Deep Wizardry, High Wizardry* $45.85●/**$12.98**

Prices in fine print are publishers' hardcover editions.
Prices in bold print are Club hardcover editions.

+ Copyright © 1990 Paramount Pictures. All Rights Reserved. STAR TREK is a Registered Trademark of Paramount Pictures.

● Combined publishers' editions
* Explicit scenes and/or language
x Hardcover edition exclusively for Club members

HERE'S WHAT YOU GET WHEN YOUR MEMBERSHIP'S ACCEPTED . . .

A GUARANTEE OF SATISFACTION. If you're not satisfied with your books, return them within 10 days *at our expense* and owe nothing. *Stranger in a Strange Land* is your gift to keep.

HUGE DISCOUNTS ON HARDCOVER BOOKS . . . as much as 65% off publishers' edition prices. Club books are sometimes altered in size to fit special presses.

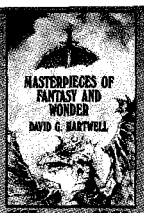
THE FREE CLUB MAGAZINE. You'll receive up to 16 issues a year. Each issue reviews the Featured Book Selection(s) plus a wide variety of alternate books from the Club's extensive library.

SHOPPING MADE SIMPLE. To get the Featured Selection(s), *do nothing*—it will be sent automatically. If you prefer another book—or none at all—simply return your Member Reply Form by the specified date. A shipping and handling charge is added to each order.

AN EASY-TO-MEET OBLIGATION. Buy at least 1 more book—at the regular low Club price—within 6 months. Afterwards, you may resign membership anytime.

RISK-FREE RETURN PRIVILEGES. If you get an unwanted book because your Club magazine was delayed and you had less than 10 days to respond, simply return the book *at our expense*.

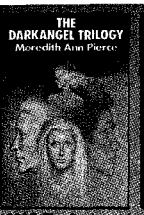
LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



1107 $7.95x

0091 *The Vor Game, Borders of Infinity* $10.95x

0174 *Magic's Pawn, Magic's Promise, Magic's Price* $14.95x



0653 *The Darkangel, A Gathering of Gargoyles, The Pearl of the Soul of the World* $44.85●/$12.98

4424 *Swords Against Wizardry, The Swords of Lankhmar, Swords and Ice Magic* $12.95x

0075 $32.30●/$14.98

2619 $15.95/$6.98

4739* $12.98x

0448 $24.95/$14.98

0042 $18.95/$9.98

THE Science Fiction BOOK CLUB®

Reading That's Worlds Apart

Please write book numbers here. If you do not want *Stranger in a Strange Land*, you may choose a different FREE book. Simply cross out the book #4796 and write in the number of the book you prefer.

Free Book #4796

17472 94

YES! Please enroll me in *The Science Fiction Book Club* according to the risk-free membership plan described in this ad. Send me STRANGER IN A STRANGE LAND—plus the 4 BOOKS I've indicated. Bill me just $1, plus shipping and handling.

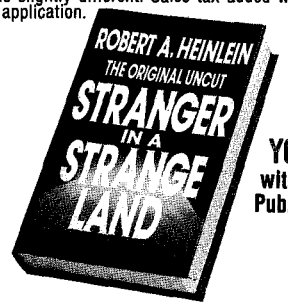
Mr./Mrs.
Miss/Ms. _____
please print

Address _____ Apt. _____

City _____ State _____ Zip _____

If you're under 18, your parent must sign here _____

Members accepted in U.S.A. and Canada only. Canadian members serviced from Canada, where offer is slightly different. Sales tax added where applicable. We reserve the right to reject any application.



YOURS FREE
with membership
Pub. Ed. $24.95

ANA 2/91

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Take this book FREE plus 4 for $1 and start enjoying

* The best SF authors from Asimov to Zelazny
* Exclusive hardcover editions available only to our members
* Access to hundreds of books of science fiction and fantasy
* Savings as much as 65% off publishers' edition prices

0067 $19.95/$11.98

4713 $5.98x

0083 $5.98x

5389 *Black Easter, The Day After Judgment* $5.98x

No Postage Necessary if Mailed in the United States

BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 1183 INDIANAPOLIS, IN

POSTAGE WILL BE PAID BY ADDRESSEE

THE Science Fiction BOOK CLUB®

6550 EAST 30TH STREET
PO BOX 6367
INDIANAPOLIS IN 46209-9490

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Less busy now, the pilot called back, hospitably, "Anybody want a Life-saver?"

"Bad for your teeth," the doctor disapproved.

"Good for the dustmouth," the pilot rejoined, amiably.

"Thanks." Carefully John extracted one piece from the battered roll. Peppermint. He welcomed it to mask the bitter tang of failure in his mouth.

The giant crater, Schrodinger, rolled under the moonhopper. Sand Lake was a detail in the rough rim of Schrodinger, just as Bolton pocked the edge of Sand Lake. The far side of the Moon: big holes have little ones cratered in to blight them, little ones have lesser ones, and so *ad infinitum*. A short while later, the hopper passed the unmistakable ringed plain Humboldt. Something flashed in Humboldt like pale green heat lightning. A moonflash, lunar rock that sparked as it cooled off after the long hot day.

Below and ahead of the hopper, the terminator, the edge of the day threw the moonscape into vivid relief, craters dark, rims bright. The crawling terminator would take four weeks to make it around the Moon back to this place. The hopper easily overtook and left it behind. The Sun glared in John's porthole. He pulled down the sun filter. In the hopper's wide cockpit window, the airless sky was black as ever over the sunlit horizon. The arc of horizon featured a wide shallow depression, the profile of the Sea of Crises.

"There she blows!" the pilot sang out. And then the Earth rose out of Crisium. The edge of night bowed from pole to pole; day was a crescent of brilliant, glazed blue. The home planet hung on the Moon's stars as lightly as a Christmas ornament in a tree. John started to cry.

The other two men had fallen silent. Fingers pressed to the corners of his eyes, John squelched the tears. He heard a pen scratching on paper. The doctor. Making notes.

The pilot took it upon himself to dispel the awkward silence. "Ever read the book *Voyager*? About the first plane to fly around the world?"

"As a matter of fact, yes," John managed to answer in an even tone.

"That's my all-time favorite book," said the pilot. They were traversing the Sea of Crises now, with the beautiful blue globe of Earth ascendant in the cockpit window. "I always think about that when I see the Earth up there. They flew around the world—around that!" The pilot waved a hand at the Earth. "Nine days, one tank of gas, no stopping, right by one typhoon and over the mountains of Africa, and everything. Fantastic.

"I see a typhoon up there now," the pilot concluded. The hopper skirted Serenity, and then began the final approach to its destination. Skillfully the pilot swooped over the rill and the mountain both named Hadley. A glint of sunlight marked the Apollo 15 Memorial. It was a very long way down. Fear of falling clenched John's stomach with a vengeance.

The radio crackled on with the information that a squad of paramedics would meet the hopper at the port. What was the status of the victim?

"Not of worry," the pilot replied. "There's nothing really wrong with him

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

that a few days of Earthshine won't cure."

"They want my opinion, not yours," said the doctor, icily.

"Hey, I know what I'm talking about. I've been on the Moon for two years and you just got here!" said the pilot, and nodded to John. "See ya around."

The doctor ordered a complete physical examination. John felt tired; he just wanted to rest. Instead he was stripped and prodded and sampled, while his examiners talked in grave undertones about multiple contusions. Meaning bruises.

John had to argue for permission to make a call out. This is like jail, he thought grimly, one phone call if you insist. Finally they let him use the hospital uplink. He got a connection to Washington, DC, USA, Earth, with the bill for it to be sent to the Space Radio Astronomy Consortium. SPARAC'S budget was tight, and the call would have to be held to a few minutes, no more. No problem. What he had to tell the Consortium's executive director was short and not sweet.

"I don't believe this!" was Schropfer's initial reaction. "There's only one man-made structure on the Moon more than three hundred feet high, and you fall off it?!"

"I didn't expect the antenna to move under me!"

"Why didn't you just hang on?"

"I panicked," John grated. "What's this crap about a supernova, anyway?" he demanded.

"There's a brand new one in the Magellanic Clouds. Baltazar was beside himself with curiosity, and it occurred to him to try the Bolton dish on it."

John swore.

"He had my approval," Schropfer said mildly. "Would have been good PR, a nice headline. NEW LUNAR RADIO TELESCOPE STUDIES SUPERNOVA."

"What for?" John asked coldly.

"Good question. Baltazar prevailed upon VLBA America to take a look. But at a declination of minus 73 degrees, only the dishes in Hawaii and the Virgin Islands could pick it up at all, just over their southern horizon. The data was noisy.

"The Australia Telescope happens to be committed to a configuration incompatible with investigating the supernova. And VLBA Pacifica is all buttoned up because of a typhoon bearing down on Easter Island! That leaves Bolton. Which is in just the right place and ready for its first trial run."

"I'd like a full report on all this."

"I take it you haven't checked your mail," said Schropfer.

"They won't let me out of the hospital tonight! They're wasting my time and theirs because I feel fine—"

"A 591-foot fall is not trivial, my friend. Not even on the Moon."

"The dish absorbed most of the impact."

With a delay of two and a half seconds, the signal traveled to Earth and Schropfer's reply came back. Schropfer seemed to pause longer than that, though, before John finally heard him say, "That's too bad."

Being in the hospital offered one single advantage: hot showers. John rubbed a clear spot in the fogged bathroom

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

WEAR THE FUTURE

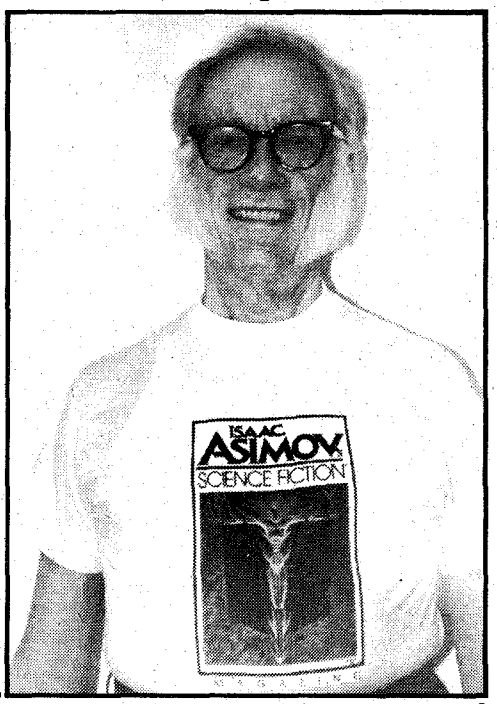
Isaac Asimov's T-Shirts are light years beyond the ordinary!

THE IAsfm T-Shirt features the color artwork of illustrator Joe Burleson. The extraterrestrial image is printed on heavyweight, high-quality fabric. Satisfaction guaranteed or your money back.

ONLY $7.95

Plus $2.00 postage and handling.
Please specify size and quantity.
Allow 6 to 8 weeks for delivery.

IAsfm T-shirt
Davis Publications, Inc.
380 Lexington Avenue
New York, NY 10017



Please send me _____ IAsfm t-shirts
Please specify size ___ S ___ M ___ L

Name _____
[PLEASE PRINT]

Address _____

City _____

State _____ Zip _____

Please enclose personal check or money order. No COD's please. New York residents please add sales tax.

Send to: IAsfm T-shirt
Davis Publications, Inc.
380 Lexington Avenue
New York, NY 10017

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

mirror and inspected his contusions. Dark bruises blotched his back, with smaller and more painful yellow spots.

It was well past midnight, Moon Mean Time. That left just enough night for it to be a very bad one. He dozed off, felt himself falling, and jerked awake in a sweat, his heart fluttering. With a loud scuff of shoe soles on a floor with a high coefficient of friction, the nurse walked in to check on him. Finally, in the last hour or two, he slept. He dreamed about moon-gray dust spattered with the vivid red of blood.

In the morning they let him go. Still wearing the despicable plastic bracelet on his wrist, he left the hospital building. The skylight over Dave Scott Plaza framed the crescent Earth. He paused to admire Earth, and another pedestrian—presumably late and rushing to work—promptly ran into him. Suddenly John wondered whether his idiotic fall had been publicized. Did people here in Hadley Base know all about it? The prospect mortified him. Breaking into a hot sweat, he hurried toward his office.

The office was an out-of-the-way cube of space shared with the staff of the Hadley Euro-American Observatory. None of them had arrived for the day yet. He checked the clock—8:13 A.M. Typical, he thought: astronomers tend not to exist at that hour of the morning. He found the report from Schropfer printed out and in his mailbox, together with a tiny video cassette. Remembering one last roll of wintergreen Lifesavers, somewhere in his desk, he rummaged to find it. Then he inserted the cassette into the vidiphone. He sat down and sucked on a piece of candy, as his wife's image appeared on the phone's video screen.

Serving as her backdrop was recognizable girderwork, the bolted-together but unfinished interior of the big space station under construction at Lagrange point 5, between the Earth and the Moon. "Hi. I'm in the center of L-5." She placed a pen in the air in front of her. It hovered with a slight slow drift. "No gravity. So I'm not going to be saying anything too serious!" She smiled, not with her lips but rather with her brown eyes. She had secured her long brown hair in Apache braids. Very much his Ramona. She retrieved the pen before it drifted away. "I have a friend I want to introduce you to. He's very nice."

Instantly, John felt a pang of jealousy.

Ramona whistled softly, "C'mere, sweetie!" Something fluttered into the picture. A bunch of highly active feathers. It attached itself to Ramona's proffered finger, and resolved into a parakeet, perched upside down relative to her. "This is my little friend, Admiral. Admiral Bird!" Ramona declared. So much for jealousy. The bird wasn't even green, it was blue. Ramona gently turned her hand and the parakeet upright. "People thought birds would freak out in zero gravity. Not Admiral! He's learned how to fly here." The bird preened the feathers of one wing.

"Humans can fly in zero gee too . . ." Well aware that she was being recorded by the astronomy office message machine and that her message would rattle around in the crowded office until John came to claim it, she had been elliptical, finishing her statement with a shy glance

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

and a curl of a smile. He understood, and he longed for her. The last time he visited Ramona in L-5, she had taken him to a special corridor of the space station. Not finished or furnished, the management intended it to be an art gallery at a future date. It had weightlessness and a picture window full of stars and Moon and shining Earth. Quite unofficially, it served the inhabitants of L-5 as Lover's Lane in zero gee. Where, as Ramona put it, you could make love like the birds called white-throated swifts, which mate in the air, tumbling together as they fly in the canyons of the West.

She ended the tape by saying, "I wish it wasn't three more weeks before you come to L-5 again. I love you and honor what you're doing. Make it work."

It was very quiet in the office. The resident astronomers had yet to appear. Odd. Enjoying the privacy, he replayed the message from Ramona. Then he read the report on the supernova.

Right ascension one hour, six minutes; declination minus seventy-three degrees. That put the supernova in the Small Magellanic Cloud and closer than any supernova since the 1987 event in the Large Magellanic Cloud. OK. An interesting object. But supernovas weren't great radio sources, not until well after the catastrophic fact.

In the case of SN 1987A (appended) the neutrino blast came first, then ultraviolet. Then the balefire blaze of visible light. Satellite observatories picked up x-radiation six months later, and gamma rays right after that. *Eleven years* later came the first whisper of synchrotron radio emission, and the first radiograph of the supernova remnant was produced by the VLA, a blurry image of the clotted shell of matter thrown into space when the giant blue star exploded.

The detection of a pulsar had been announced in 1989. And retracted in 1990. The "pulsar" turned out to have been a fluke in the observing equipment at Cerro Tololo. The real thing had yet to be confirmed: thirty years and still no pulsar, though theory predicted that the supernova should have left one to mark its place.

Baltazar knew all of this, yet hadn't been able to wait even a day to have a look at this newest supernova!

The VLBA data was interesting in a Rorschach Way—the human brain could imagine something significant in it. Much less imaginative, the VLBA supercomputer had not managed to massage the data into anything recognizable. Schropfer had been in management, fund-raising, begging for bucks, so long that he couldn't even make a sound scientific judgment anymore, John thought disgustedly. He rubbed his neck. There was a nagging twinge, a crick in his neck. It bothered him more than the soreness and stiffness in the remainder of his body.

Dec–73. Solidly in the Bolton reflector's observing swath on the celestial sphere. And RA 0106. The supernova had appeared near Bolton's zenith. Ironic: right now Bolton was in a great position to register the radio data that might take months and years to show up.

John called Schropfer again. "For what it's worth to look at the supernova, we can repair the dish," he said, without preamble. "Some segments fell out. But we have spares in case of micrometeorite hits."

Schropfer shook his head grimly.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Jen did a damage assessment, which I just got. It's worse than a hole. Two of the support pylons are buckled and the whole dish is sagging. As in, out of round. As in, inoperable!"

"Oh, no!"

"What did you expect? You're two hundred pounds on Earth, the suit's just about that much more, and I'm too upset right now to convert to newtons what the amount was that hit the dish! How in the name of perdition am I going to meet the cost of replacing pylons?!"

In shock, John shook his head. The Space Radio Consortium subsisted on whatever money its member universities could spare. Plus funding that Schropfer elicited from government and the private sector. Building the Bolton dish had blown the seams of SPARAC'S budget and, furthermore, had put SPARAC embarrassingly in debt to the SETI Society. Schropfer continued, "Hadley Hospital sent me a report on you, too. I conclude that the worst damage to you is your ego. Too bad. It would have been cheaper to fix *your* bones!"

Thanks for the sympathy, John thought, you little son-of-a-bitch! He signed off curtly. The pain in the neck had a name now. Schropfer.

The fax machine pinged and chattered. There was Jen's report. Twelve lines long. She didn't specify what did the damage. As if God or the impersonal Universe had flicked something into the dish. She was very specific, though, about the extent of the damage. And the result. To function, the reflector had to have a perfect spherical curve. And now it didn't. It sagged. He felt sick.

Throwing down the paper, he left the office. Rapidly he walked through the service tunnel toward Hadley's moonport. Residual moondust rasped underfoot. Half-formed in his mind was the idea of quitting. Just like that. Give up and walk away. And let Schropfer have the whole mess.

First he had to find out when the next shuttle to L-5 would be leaving Hadley.

He happened to see the port director's administrative assistant before she saw him. He disliked her: brightly blonde and polished she always smiled too much, insincerely, and in the context of explaining why it would not be possible for the port to meet some need on the part of the Sand Lake project immediately, or according to the original schedule, or at all. He ducked into a hangar. Watching the woman walk by, he compared her to Ramona, very unfavorably.

A casually uniformed man approached, wiping his hands with a towel. "May we help you?"

"I'm—looking for one of the pilots." John remembered the name stenciled on the blue jumpsuit. "Cantu."

"Over there in the moonhopper. Bang on the side."

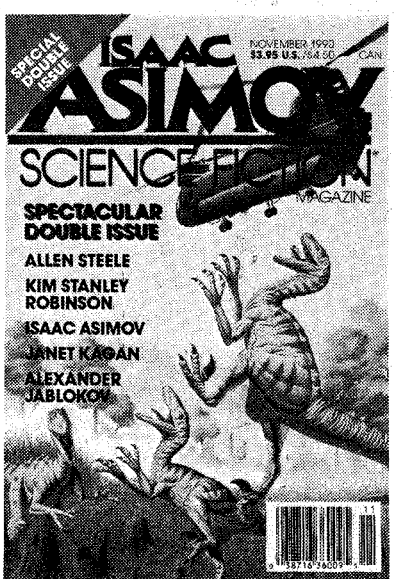
John went that way, vaguely framing his inquiry about transportation to L-5. It ought to sound casual, he thought. A sharp smell of hot glue permeated the hangar. As he walked on the floor he felt traces of something underfoot, not gray moon grit, but slick plastic powder. The moonhopper had every service hatch and access panel wide open, and part were lined up on the floor. When John banged as directed, Cantu popped out of a hatch. "Hi! Doin' better? Did you know you almost had tons of com-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

THIS YEAR ENTER ANOTHER DIMENSION.

SUBSCRIBE NOW AND SAVE 29% OFF THE BASIC PRICE

1-800-333-4108



☐ Please send me 18 issue of ISAAC ASIMOV'S SCIENCE FICTION MAGAZINE for only $29.50—I save 29% off the basic price.

☐ Please send me 12 issues for only $19.97.

ISAAC ASIMOV'S SCIENCE FICTION®

P.O. Box 7058
Red Oak, IA 51591

Name _____

Address _____

City _____

State _____ Zip _____

MTSG-3

Please allow 6-8 weeks for delivery of first issue. *Outside US & Poss. 12 for $25.97, 18 for $38.75.*
All foreign orders must be paid in advance in U.S. currency.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

pany back at Sand Lake?''

''We did?''

''The observatory astronomers here. They went nuts. They would have gone right over to Sand Lake. Except it seems you don't have room for them yet, or the power supply, or the connections for their instruments.''

''Not until Phase II,'' John murmured.

''So they hauled out to L-5.''

Mired in Earth's tidal forces, always facing Earth, rotating on its own axis only once a month, it would take the Moon days to turn far enough for the supernova to be seen from Hadley Base. That accounted for the lack of life in the observatory office. Obviously. He was not thinking clearly today.

Cantu asked, ''Ready to go back to study the supernova?''

Going to L-5 was not an option. Not if it meant running away from his work, bumping into other astronomers who had rushed to L-5 to follow theirs! Dislocated from the idea that brought him to the port, his thoughts tumbled.

''In case you're wondering, this vehicle isn't deceased, just having preventative maintenance!'' Cantu affectionately whacked the hull of the hopper.

John registered the hollow thump. ''That's not metal,'' he said. ''Come to think of it, metal doesn't predominate in any of our spacecraft and vehicles. Composite materials do.''

''Huh? Oh, heck yeah. Fiber, resin, glass and glue is where it's at. *Voyager* was the first aircraft,'' Cantu enthused, ''to really exploit composite construction—otherwise no way they could have done it. Now everything in aerospace is like that.''

Thinking hard, John spoke slowly. ''I've got a problem. My radio telescope was damaged yesterday. It's not made of metal—here, that was neither necessary nor desirable. The understructure is a species of L-glass/thermoplastic composite.''

''Sounds familiar.''

''I've got to get it fixed right away, and I have an idea, involving glue, but I need a professional opinion.''

''In that case, you were talking to the right guy in the first place!'' Cantu whistled loudly. ''Hey, Rod! That's Sylvester Rodriguez. A master mechanic. Don't call him grease monkey, more like glue! Come into the break room and I'll put on some coffee.''

Later that afternoon, he made a call to Ramona. She was unavailable, at work in the white room where she was a senior technician. So he let the vidiphone on the other end take a message. He felt awkward. The accident had left a bruise on his chin, somehow banged against the helmet. ''Hi, love,'' he began. ''I'm looking forward to meeting Admiral Bird. I'm in Hadley right now because we had a problem with the dish yesterday. Right now—it's Friday 3 P.M.—I'm on my way back to Sand Lake. I will make the dish work.'' The last sentence came out with a vehemence that surprised him. His face felt flushed. Lamely he added, ''I took a bit of a fall yesterday and—well, never mind, just a bruise or two. Have a good weekend up there. Bye.'' He wanted to say more. But not to the L-5 Technical Support Division's message machine.

Heavily laden this time, the moon-hopper pitched up on the blast of its

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

altitude jets. This time John rode shotgun, beside Cantu. He had a vertiginously good view of the lunar Apennine Mountains: a mosaic of intensely bright and dark shapes, geological chiarosouro. Canto flicked the jet controls. The hopper zoomed away toward the far side of the Moon.

Since yesterday, the terminator had moved further west, further from Sand Lake. Good. Temperatures would have settled down now, all cooled off, improving the chances of fixing the dish. "I really appreciate this," he said aloud. "I'm sure you guys could find a more entertaining way to spend your weekend, even in Hadley Base."

Cantu laughed. "Supernovas don't happen all the time, and everybody in Hadley's got the itch to see it. No way I'd pass up the chance to *hear* it." These men weren't European, Castilian, like Baltazar. Indian blood darkened their skin—reminding John of Ramona—and they had the kind of casual and practical outlook that he had met in Mexican-American men before. "This job goes on my resume," said Rodriguez, from the back seat.

The hopper made the transit from sunlight to night. Glaring gray moonscape turned to silver, a soft bluish silver: Earthlight graced the maria and the crater rims. Magnificent desolation, Aldrin had said. That was true, but only in the light of Earth. And the Earth was sinking into the horizon behind the hopper.

John thought about the *Voyager*, and its long thin wings that flexed in flight. The two pilots had used biological metaphors to describe the experience. The plane porpoised. It felt like riding on the back of a pterodactyl. It flew like a great flapping seagull—around the Earth.

Dick Rutan and Jeanna Yeager endured danger and discomfort, breaking-point emotional strain, nightmarish problems. He was no pilot, no derring-doer like those two. Like them, though, he had a machine made out of exotic materials, a dream, a dream machine that could frame a nightmare. Rutan and Yeager never gave up. He wasn't going to either. And if the attempt to fix the dish failed, damaged it worse than ever, if everything hit the fan . . . he was not going to quit even then. Schropfer would have to fire him. His neck hurt. He ignored it.

Below the hopper was the far side of the Moon, alien land lit only by the cold white stars. "I gather that you radio astronomers prefer a quiet neighborhood," Cantu commented. "But what do you do for fun?"

"The habitat is pretty basic. No amenities. We read a lot. I work with an old hen who reads murder mysteries, and when I ran out of my own books I started on hers." Was there a dark psychological angle—something about suppressed hostility in Jen's character? Maybe it was just that too many hard weeks of being cooped up in the habitat, too closely with too few people, promoted homicidal fantasies. He himself had been finding the murder mysteries enjoyable.

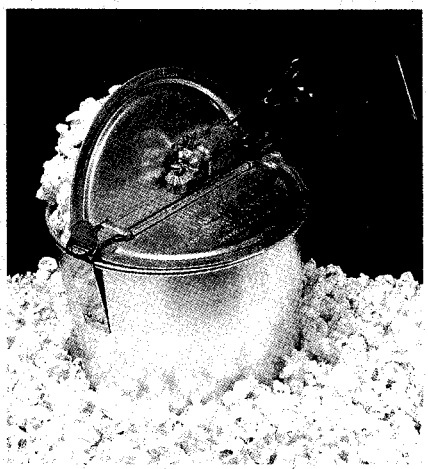
"That's the only way I came to read *War and Peace*," Cantu answered breezily. "Cause this guy in my bunkroom had it."

Rodriguez was a different type, a slight and quiet man, all business.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

MAIL ★ ORDER ★ MALL

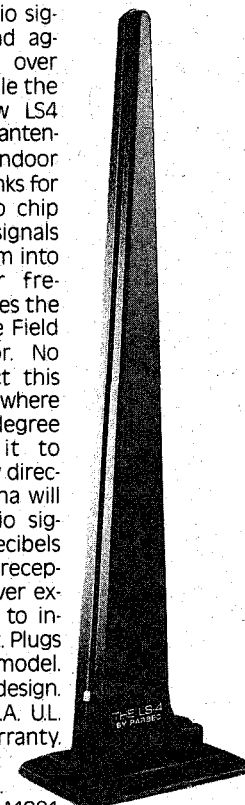
▼ GOURMET POPCORN POPPER



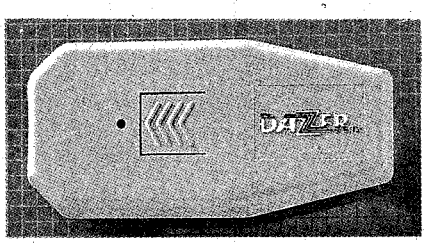
All new high temperature 6 qt. popcorn popper. Most electric and hot-air poppers "puff" the corn more than they "pop" it, leaving it tough with hard centers. This flat-bottomed stove-top popper reaches 475° and pops full in two minutes with 6 quarts of the best popcorn you ever tasted. Stirring paddle with through-the-crank handle virtually eliminates burnt or unpopped kernels. Wooden handle for safe grip, two dump lids. Pop without oil for delicious diet popcorn. 370 calories per 4 qt. bowl. Produce tender, fluffy, old fashioned movie theater popcorn. Made in the USA. **$27.98** ($5.25) #A1963.

▼ THE BEST RECEPTION EVER!!

Eliminate radio signal fade and aggravating cross over signals that garble the sound. The new LS4 omni-directional antenna is the only indoor antenna that thinks for itself. The micro chip brain receives signals and isolates them into individual clear frequencies. Features the Gallium Arsenide Field Effect Transistor. No need to redirect this antenna. Leave it where it is and its 360 degree radius allows it to receive from any direction. This antenna will boost your radio signals up to 24 decibels for the clearest reception you have ever experienced. Easy to install, light weight. Plugs into any stereo model. Unique modern design. Made in the U.S.A. U.L. listed. 1 year warranty. Dimensions: 3" x4.125" x 17.25". **$58.98** ($5.25) #A1891.



▼ THE DAZER™

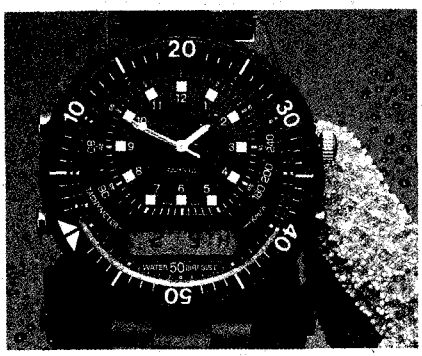


Even the most dedicated canine aficionado can sometimes encounter unfriendly dogs. Dazer™ provides a humane way to repel their advance, emitting ultrasonic sound waves inaudible to humans and totally safe for dogs (unlike mace and other common deterrents). Pocket size (4¾" long) plastic case can also clip on belt; takes 1-9V battery, included. For joggers, hikers, bikers, seniors and kids—plus the proverbial postman. **$29.98**, ($3.00) #A1829X.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

▼ DIVER'S WATCH

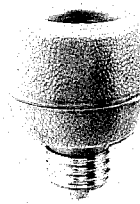
The Diver's Watch, priced under $50, is rated waterproof to 5 atmospheres (over 150'). The movable bezel, case and band are all "black chrome" plated in a rugged matte finish. Two sunken faces provide fully independent digital and analog timekeeping, so you can set one face to home time and one to travel time. Date, day and month display; alarm; 1/100 second chronograph with lap timer; choice of hourly chime, 12 or 24-hour format. Precision Japanese movement. 1-yr. warranty. **$39.98** ($5.00) #A1490.



▼ INNOVATIVE IONIZER

A sophisticated electronic device that uses nature's way of cleaning air — emitting trillions of negatively charged ions that act like magnets, attracting microscopic particles of dust, smoke and pollen. This tiny unit (1½"x3") provides an ingenious solution, plugging right into any wall outlet. With "on" indicator light and collector pad that can be rinsed. **$39.98** ($4.00) #A1867.

▼ TEACH AN OLD LAMP NEW TRICKS



Any lamp that takes a standard bulb can be updated with the Touchtronic dimmer. No rewiring needed-just screw into lamp socket. Then your touch on any metal part becomes the "switch"-touch once for low light, again for medium, a third time for full wattage. Perfect for metal-base lamps, since you can touch anywhere; easy enough on others because touching the harp, shade frame, socket or even a metal finial will work. Handy (and safe) when you're entering a dark room, great at bedside (no more wee-hours fumbling) and a real comfort to the arthritic or the ill. You'll save time, money and electricity-no more 3-way bulbs to buy and you pay for only as much light as you need. U.L. listed; one-year factory warranty. **$15.98** ($4.00) #A1700. 2 for **$27.98** ($6.00) #A17002.

TO ORDER: Send check with item number for total amounts, plus shipping & handling shown in ( ) payable to **MAIL ORDER MALL**, Dept. 021 AN P.O. Box 3006, Lakewood, N.J. 08701, or call TOLL FREE **1-800-365-8493**. NJ residents add 6% sales tax. We honor MasterCard/Visa. Sorry, no Canadian, foreign, or C.O.D. orders. Satisfaction Guaranteed. 30 day money back guarantee for exchange or refund. Allow 30 days for delivery.

Magalog Marketing Group Inc. © 1990
1905 Swarthmore Ave., Lakewood, N.J. 08701

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"That it down there?"

John replied, "That's the Lunar Far-Side Very Low Frequency Array in the Sanduleak walled plain. Which was named for a twentieth-century astronomer and promptly if disrespectfully corrupted to Sand Lake. Look on the far edge of Sanduleak. See the bright dimple? That's Bolton. And the reflector."

"How does it work?"

"It sits there. It's a photon bucket. Reflects incident radiation to the center, where the antenna is. The antenna is what moves. There's an older dish of this kind in Arecibo, Puerto Rico—a real workhorse in my field." Reflectively, he added, "Bolton is to Arecibo as *Voyager* is to, oh, maybe a Cessna. Principles the same, materials radically new and different. Composite construction makes Bolton flexible—and fragile. Arecibo stood up to a major hurricane once, in 1989. Earth gravity alone would flatten Bolton."

The reflector was eggshell-thin but not rigid, the pylons stiff yet resilient, the whole structure nonmetal-like, quirky to the extent that one did not know what to expect of the exotic materials. John knew. He had worried over the quirks of the machine for all of the months of its construction. A kibitzer like Schropfer could have Bolton's specs strewn all over his desk, and still not know what to expect of the structure.

The hopper swerved over the shore of Sand Lake, braked and began a slow hovering descent toward Bolton. The habitat was tucked into crater Bell, right on the edge of Bolton. Little craters have lesser ones . . . John radioed. "Anybody home?" Home sweet home, he thought. Cold showers and gritty floors. Zheng's bad breath. Jen's chocolates, shedding oily brown particles on the pages of technical reports as well as murder mysteries. And Edward's mild-mannered, rational, relentless pessimism.

Jen's voice replied. "Welcome back. Whatever is that load on top of the hopper?"

"Popsicle sticks," said John. "And duct tape." Rodriguez grinned briefly.

"Cantu, set us down close to the edge. Don't worry, it's reinforced, and will not crumble. There's a crane down there that can hand the cargo under the dish. X marks the ideal spot."

"Can do," said the pilot, winking at the pun on his name. He put the hopper down neatly on the landing field's X by the brink of Bolton.

John invited them into the control room. Jennifer seemed as shocked as a hausfrau that he had brought guests home unannounced.

The guests seemed genuinely interested in the instruments and computers, and the radio contour map tacked up on the wall. "I thought your instrument wasn't working," said Rodriguez.

"We have two radio telescopes at this facility," Jennifer explained. "The Very Low Frequency Array has been operational for three months now." Clicking into professor mode, she explained how her VLF Array was mapping the magnetosphere of Jupiter.

"Most stars are not single," she was saying. "Binary systems are the norm. Our Sun was very nearly a double star, the other one being Jupiter, if Jupiter had been somewhat bigger. Jupiter is nearly a star, and it generates its own heat and an immense magnetic

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

field . . .''

John checked the E-mail. There was a message for him, from Ramona, datelined Friday 5:14 P.M. YOU'RE IN PAIN AND I AM WORRIED! He stared at the message, unconsciously rubbing his neck.

''She's right,'' said Jennifer, behind him.

John erased the mailmessage. ''None of your business,'' he said brusquely.

Rodriguez had disappeared into the restroom, and Cantu was being introduced to the observatory's main computer by Edward. Jennifer asked, ''Why did you bring these people here?''

''They're going to help us fix the dish.''

Her eyebrows shot up. ''As easy as that?''

''Maybe not. It's a long shot. An idea.''

''When?''

He shrugged past the crick in his neck. ''No time like the present.''

From this side, the dish was the dim convex canopy of a forest of pylons. Anchored in the crater floor, the slim pylons rose up to branch at the top. The branches terminated in twigs, each attached to one segment of the dish. The position of each dish segment could be adjusted by the control computer. Sensors told the computer the precise position of every segment. Adding everything up, the computer had found the dish sagging. The human eye could not detect the sag, at least not now, with artificial lights patching the lunar night under the dish.

It was the Moon's slow midnight. But human affairs adhered to the twenty-four-hour artifice of Moon Mean Time. They had spent Friday night unloading the cargo from the hopper and getting ready. John had, again, slept badly. This time his neck hurt all night. And he was troubled by the kind of garish bad dreams that he had been having in recent weeks, the color-pandemonium with which his brain attempted to compensate for the monocromatic tedium of waking life on the Moon. Now it was Saturday morning, still early, 9 A.M. John circled around the site with an impatient mixture of gliding and skipping steps. He wanted to get this over with.

Floodlights illuminated one of the pylons. Twenty feet above the crater floor, it bent at an angle of some fifteen degrees. The hollow-cored pylon had buckled like a soda straw. Now a long cable descended from the crown of the pylon. The cable ended at a winch anchored on the crater floor, as far away from the pylon as possible.

Two ropes, shorter than the winch cable, dangled from the top of the pylon. John called, ''Jennifer, you and Zheng on this one. You'll back off and hold it taut. Out that way—right angles to the cable. Don't actively pull unless you get the word.'' Jen rapidly translated that into Chinese for Zheng. John continued, ''You all know how hard it is to get good traction. So use the anchor posts. Cantu, you and me on the other rope. Edward operates the winch, and Rodriguez spots. He'll tell us if the pylon sways one way or another.''

Rodriguez signaled assent.

The bulky moonsuited form of Edward fussed over the winch. Edward said, ''This procedure still strikes me as illogical. The basic notion is to *lift*.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Right?''

''Ever been to Easter Island?'' John asked, ''That's how they got the stone heads up. A bunch of people on the ground, pulling on the longest ropes they had.''

''I hardly think that qualifies as a reliable precedent . . . And *what about the stress on the points of attachment*?''

''For the record,'' said John, ''I'm not 100 percent sure that this will work. I *am* sure it's the thing to try. Ready, everybody? Let's do it.''

Moonsuited forms shuffled to their places. At a signal from Rodriguez, Edward turned on the winch. It whirred soundlessly in the airlessness here. The cable oscillated, went taut.

Fifteen hundred feet across, the dim down side of the dish stretched away to the ends of the crater. John felt a sudden conviction of futility. Edward was right. They might as well have been insects, busy but ridiculous ants, trying to reshape this vast thing.

Rodriguez said rapidly, ''Pylon's starting to straighten out. Going true. Still true. It's trying to lean to the right!'' he waved an arm. ''Left rope, pull!'' Jennifer and Zheng pulled. The Chinese man had a foot propped on an anchor post, and pulled mightily.

''Let up! Left, let up! Right side pull!''

John pulled. His feet slipped and he skidded. Cantu stumbled. ''Yipe!'' They got anchored again, then, and with their combined mass under the rope, pulled. John felt the rope come to them. Over their heads, the pylon and the filmy acres of dish had actually responded to their puny effort.

''That's it! That's it! Ropes, stop pulling! Just hold steady there. Slow the winch—that's about right—Left! Pull, but not too hard! Good! Ease off that winch—anchor the side ropes—put the winch brake on. Not like that!'' Rodriguez headed towards the winch with the loping strides of a Moon veteran making haste. ''That's not how the brake works!''

''Oh,'' said Edward.

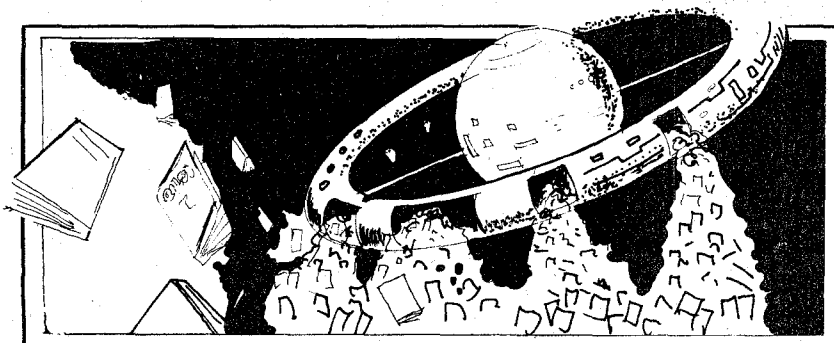
Now the pylon looked straight. Only, like a bent soda straw, it had one terribly weak point. Without the winch cable holding it, the pylon would keel over.

Climbing into the driver's seat, Rodriguez started the crane. It was a light, long-necked, mobile piece of machinery on treads. Using the crane, Rodriguez hoisted one end of a moonglass beam. The inside of the beam was reamed out to match the curvature of the pylon and coated with glue. With some help from the ground he placed the beam up against the pylon. Glued, it stuck. Then he positioned another beam on the other side of the pylon. ''Popsicle sticks in place,'' Rodriguez commented. With adroit operation of the crane and helpers scrambling on the crater floor, he wrapped the splinted pylon with a ninety-yard length of plastic fabric, stretching and wrapping and gluing it securely in place.

Then the glue had to cure. It was time for lunch anyway, though not as simple as knocking off and grabbing a sandwich on the spot: taking off the moonsuits was a chore in itself. After lunch, Rodriguez took a nap. Cantu helped himself to a murder mystery.

According to the computer, the dish sagged less now. So far, so good. John

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



WAREHOUSE SALE

Our warehouse is full—full of stellar back issues of *Analog Science Fiction/Science Fact* and *Isaac Asimov's Science Fiction Magazine*. That's why we're having our first warehouse sale. For only $9.95 plus postage and handling, we will send you an assortment of 10 classic issues of *Analog Science Fiction/Science Fact* or *Isaac Asimov's Science Fiction Magazine*. That's less than $1.00 per issue, an unprecedented savings.

Please send your check or money order (no COD's please) to:

Warehouse Sale
Davis Publications, Inc.
P.O. Box 40
Vernon, N.J. 07462

Please send me

_____ An assortment of 10 issues of *Analog Science Fiction/Science Fact* ($9.95 plus $3.50 postage and handling).

_____ An assortment of 10 issues of *Isaac Asimov's Science Fiction Magazine* ($9.95 plus $3.50 postage and handling).

Please send to

Name _____
(Please Print)

Address _____

City _____ St _____ Zip _____

While we cannot accommodate requests for specific issues, we guarantee that you will be delighted with your surprise assortment and will enjoy discovering new stories and authors. Also, at this great price, these back issues will make wonderful gifts for your science-fiction-loving friends.
Available in U.S. only.
All 10 issues will be delivered to you within 6 to 8 weeks. HTKC-8

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

rubbed his neck, inflamed by the morning's exertion in the spacesuit. The more damaged pylon was yet to come.

Jennifer came into the control room to check the accumulating data from her LFSVLFA. She asked, "How *did* you get that material? I didn't know we had that much credit with the Hadley warehouse."

"We don't. I faked an appropriation authorization that said something about a state of scientific emergency. And a facsimile of a fund transfer writ. The check'll bounce Monday morning."

She rolled her eyes. "Oh, Lord! This had better work!"

He shrugged around the pain in his neck. "My responsibility alone. I didn't tell our two friends that I was fleecing the Port. Cantu probably has an idea, but he can plead innocence. If this fails, it's my funeral."

"Don't say that! We didn't tell you Thursday night—but one of the air valves in your suit jammed when you fell. And if we hadn't found you and taken the risk of moving you right away—!" She left the outcome unspoken. "It was the sound of your breathing. I was sure you couldn't get enough air. I was right. When we took off the helmet you were turning purple!"

Not knowing quite what to say, John said, "Thank you."

"I was overjoyed when you sat up and talked." Jennifer added, quietly, "It haunts me. I could have lost a good colleague and a good friend."

It went both ways, he thought, with or without chocolate crumbs. "You're that for me too, and you have been for years," he said. "I'm not handling everything so well. I'm sorry."

"It's half fixed," she said briskly. "You brought good help. If we had the facilities, I'd bake cookies for those guys. Very handy people—unlike somebody else we know of Spanish ancestry!"

John nodded ruefully. "Murphy's Law and Baltazar's Rule."

She spelled out that old joke of theirs. "The better the theoretician, the more things go wrong when he lays his hands on the instruments. Lord, if he'd been here this morning the dish probably would have fallen down around our ears."

They grinned at each other.

Rodriguez announced that the glue was 97 percent as hard as it was going to get. Cantu stretched and groaned. "Is this gonna be worth it?" He levered his feet into his spacesuit.

Struggling to squeeze into her own suit, Jennifer puffed, "Good question." She had always been skinny as a rail. But since moving to the Moon and being form-fitted with a moonsuit, she had put on weight—enough to make it hard for her to don the suit. She decided to pause for a lecture. "Normally, radio astronomers don't scramble to observe a supernova. Optical astronomers do."

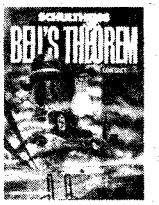
"Especially when they find themselves on the wrong side of the Moon." Like an eel, Cantu wriggled into the top half of his own suit.

"It's a truly cataclysmic event, a giant star dying, blowing most of its mass out in gusts of ionized matter. I would expect radio thermal emission, though not quite this soon. Heat noise. In science," she continued, "it's also important to check for that which one does not expect to detect, or not yet."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

FULL COLOR
GRAPHIC NOVELS
THE NEW DIMENSION

BELL'S THEOREM
Trilogy of Schultheiss
$10.95 ea.
37 62 74
Medical experiment turns nightmare in parallel world.



ABOMINATIONS
by Hermann
$9.95
Short horror stories. 80

FIRES
by Mattotti $12.95
Mystical possession ends in expressionist inferno. 48

MAGICIAN'S WIFE
by Charyn/Boucq $14.95
45 Werewolf wife is victim of magic.

FALL OF THE HOUSE OF USHER
and other Poe tales by Corben
$10.95
13

GODS IN CHAOS and **WOMAN TRAP**
by Bilal $12.95 ea. 49 50
Paris, 2020, Egyptian dieties struggle for power.

MAGIC CRYSTAL
by Moebius/Bati
$6.95
S&S quest for young adults. 67

VULCAN'S FORGE and **THREE SUNS OF VINA** by Leloup
$6.95 ea. 65 76
Teenage heroine in detailed technological sci-fi adventure.

TIME TRAP
by Jacobs $8.95
For all ages.
Will he get out alive? 66

MAIL ORDER TO: ANALOG MAGAZINE
Dept. 291, 380 Lexington Ave., New York, NY 10017

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

You do not need to use this coupon if you need more space

Please send me the graphic novels circled below:

13 37 45 48 49 50 62
65 66 67 74 76 80

Please add $2 postage/handling per book; NY orders add 8.25% sales tax. Please send check/m.o. only. Do not send cash. Allow 6-8 weeks.

TOTAL ENCLOSED: $ _____

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"What's that?" Cantu asked, carefully sealing his waist seam.

John said, "The corpse, spinning in its grave."

"Doin' *what?*"

Jennifer chuckled. "He means a neutron star. "The core of the supernova radically collapses into a mass of neutrons, a neutron star, with all of the angular momentum—the rotating force—of the original star compressed into a much smaller package. So the neutron star spins rapidly. Several revolutions per second."

"How do you know?" All suited up, Rodriguez waited, casually leaning against the airlock with his helmet tucked under one arm.

"It also has a strong magnetic field inherited from the original star. This generates powerful beams of radiation which rotate as fast as the neutron star spins. Like the beam of a lighthouse. Our Solar System may or may not be in the path of the beam. If it is, we identify the source as a pulsar, and it can be quite a lovely radio object," said Jen. "The pulsar takes time to crystallize, though." John pushed down on the shoulders of her suit. The suit settled and her head emerged from the neckhole. "Thanks. No, right now—unless all of our theories are wrong—the neutron star at the core of that supernova is buried in fire and fury. It isn't a pulsar yet."

John checked his air supply. Zheng had fixed the jammed valve, Jen said. It seemed to function perfectly. He took a deep breath. They had in-suit air for six to eight hours. Enough time for the rest of the repair job—to make it or break it.

This pylon was more bent than the first one because John had hit the dish closer to it. Rodriguez made a close inspection. Everybody else stood there and watched passively. They were all tired.

Pieces of dish lay on the crater floor. John picked one up. He turned the shard over in his glove. Thin, light glass manufactured from the lunar regolith, it had a shiny metallic coating on one side. With a chill, he remembered falling toward the shiny dish, expecting to die. He would have died, had not the flexing pylons absorbed the impact; had not the matrix of glass segments sagged like a safety net before breaking under him. Looking up, he saw stars through the jagged hole in the dish.

"I'm concerned," said Edward, "that our efforts will damage the dish. It would be very unfortunate if we overstressed the points of attachment of the pylon to the dish. Look, the angle of the bent portion is more extreme than the other one was. The branches are sharply counter-bent. Can they take the strain?"

"I think so," John said shortly.

"The pylon might even break there where it's bent and fall down," Edward persisted. "Of course, the opportunity to study the supernova may be worth taking considerable risk, scientifically speaking. I don't know about that."

Jennifer put her helmet against John's, using sound conduction to speak privately. "I do know."

"I want to fix it," he said.

"You're doing this just because you're a stubborn coot who's got his back up. And the rest of us like you enough to work our tails off for you."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Like winter rain, Edward did not let up. "Shouldn't you run this by the project engineers, or possibly Mr. Schropfer, before attempting—"

On the in-suit radio Jennifer snapped, "Edward, your point is valid but your timing stinks. Go to that winch and get ready."

Rodriguez had an announcement to make. At least five-sixths of the pylon's branches were still securely attached to the dish. "Good enough for government work!" The bent section of pylon was unlikely to break and fall off. If it did, he'd holler. And everybody should run like hell.

The winch pulled. The kink in the pylon straightened out by degrees. John imagined what he would have heard if there had been air to carry the sounds: the groan of the pylon material and squeaks from the mosaic of glass segments. Maybe reports of glass breaking. Not that, he hoped to God.

With one alarm when it keeled to the left, and those on the right side had to scrape and haul, the pylon was jacked upright, the winch cable braked. Then Rodriguez and his helpers swarmed around the pylon to put on the splints and the cloth and the glue. Edward vanished into the control room.

John piled up the broken dish segments, then swept the crater floor clean of glass fragments. You make a mess, you clean it up. He probably made a funny figure, a spacesuit pushing a broom. Edward radioed from the control room.

"It's better," Edward reported breathlessly, "but not quite better enough. However, with some reprogramming the computer may be able to compensate for that by adjusting individual segments. I can't promise anything, of course, but I'll do my best."

"How about breaks in the dish?" John asked quickly. He had sweat that needed wiping off his brow. Not possible with a spacesuit on. "Stress fractures—?"

"Not indicated, though the computer isn't really programmed to detect stress fractures of the kind that might have been caused by today's activities. It's geared to analyze micrometeorite impact damage."

"Never mind. It sounds good enough to go with."

Within an hour, exhausted snores could be heard in the habitat. It was Sunday now, 12:17 A.M.

Past mere exhaustion, John felt morbidly sleepless. Sitting in bed he read the supernova report again. Then somebody knocked on the door. "Come in," he said quietly and peevishly.

"It looked to me like you had a sore neck all day," Jennifer said without preamble.

"Yeah. A crick or something."

"How is the crick tonight?"

"It's in fine fettle," he said sourly. "A really great crick."

She probed his neck with her fingers.

"Ouch!"

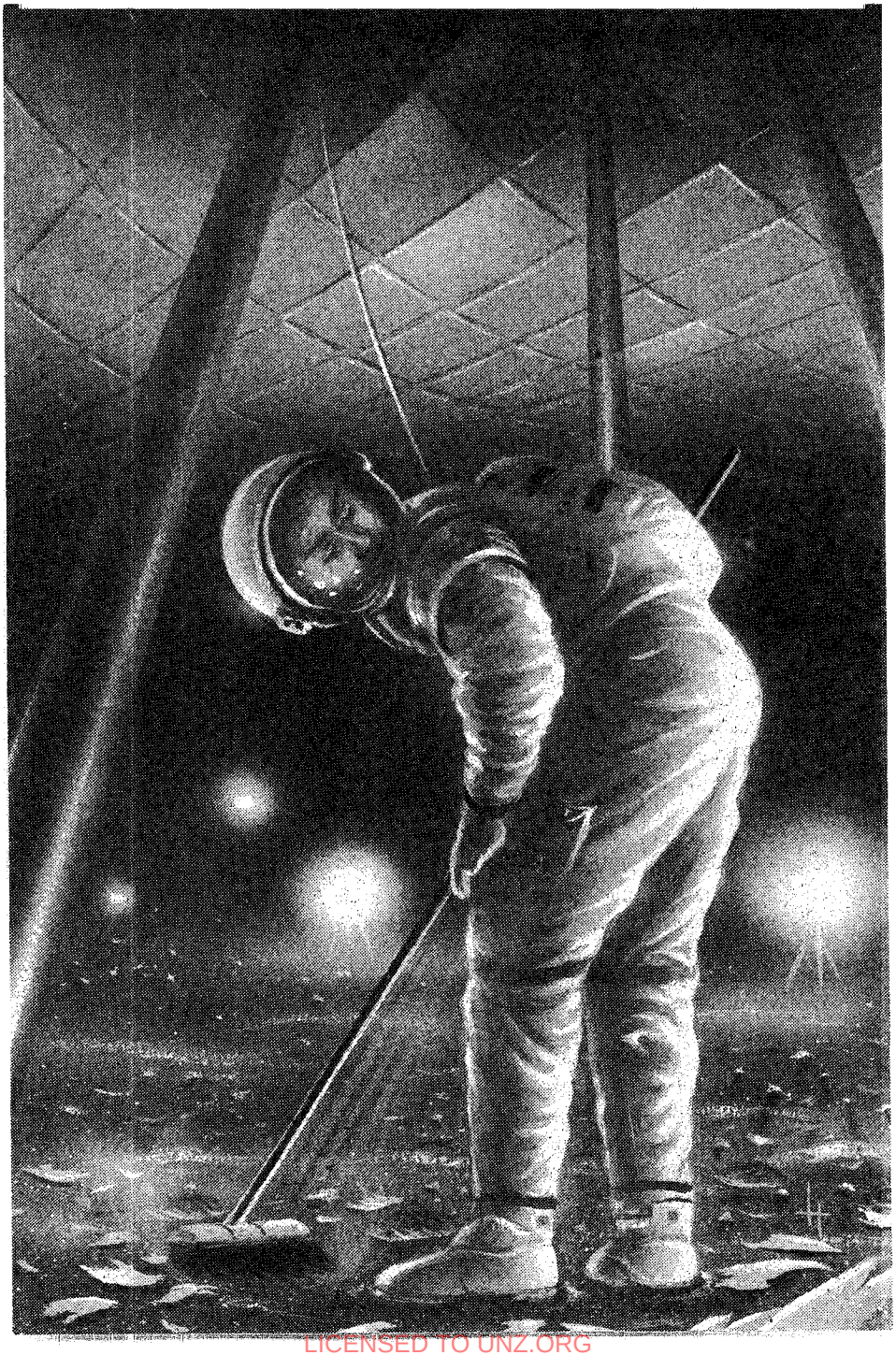
"Let's try this on it. It's my arthritis liniment."

"I didn't know you had arthritis."

"That is my darkest little secret," she replied.

The liniment went on cool with a reek of acetone. Then it started to feel warm. Jennifer massaged the neck. To his gratification, the knot of muscles loosened up under her fingertips. Satisfied, Jennifer told him to call it a night, and she

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

departed. He intended to read for a while longer, but he fell asleep with the pages of the report scattered over his bunk.

And dreamed about falling toward the dish.

This time he did not jerk awake. He crashed through the dish, with bright glass panes of it spinning away. Then the dreamer lightly landed in a forest—a tropical forest, improbably situated below the Bolton dish. Color surrounded him, but not the lurid colors of his bad dreams. Lush greens, blossoming bold reds, wild purples and pinks, colors of Puerto Rico. In technicolor. The dreamer was pleased with himself.

A glossy black toucan perched on a branch, bobbing its head with the great yellow bill. Then he saw the hummingbird. Green as a June bug, it hovered near him. The tiny bird hummed. A beam of golden light illuminated the humming bird. The dreamer looked up. The sky was a convex blue dome with a hole in it. Golden light spilled in through the hole.

The reading light was shining into his upturned face. 7:03 A.M. Sunday morning, by the clock, and he had slept, not long, but well.

Out of force of habit, John checked the E-mail. The doctor in Hadley crisply pointed out that he had *not* given John Clay permission to return to work. Two news services and a tabloid wanted to interview Dr. Clay about his death-defying fall from a telescope on the Moon. Finally, Schropfer had messaged, RECEIVED CONFIRMATION OF APPROPRIATION REQUEST FILLED. **WHAT** REQUEST? John erased all of the messages.

Another habit, instilled over almost a year of being project manager here, was that of counting noses. Could everybody be accounted for—was anybody missing, out in the lunar environment, in trouble? So he immediately noticed the absence of Rodriguez from the group.

"Checking the repair job," Cantu informed him.

"The shape of the dish is just inside the acceptable parameters," said Edward, proudly, "now that the computer has made more than six hundred coordinated adjustments to the segments." Disheveled, Edward appeared to have fussed over the computer most of the night, maybe sacked out on the control room cot for a bare hour or two.

"We're ready," said Jennifer, significantly.

John shook his head. "I just remembered something," he said. "A problem up in the equipment house. That's why I went up in the first place."

Instantly Edward volunteered to go up the catwalk and attend to whatever it was. But Jennifer said, "No. He needs to get back up on the horse."

This time he was trembling inside the spacesuit, probably pale as a piece of chalk, glad that the suit concealed those facts so well. "You're three-fourths of the way up!" Jennifer encouraged over the radio. He glanced back toward the gaggle of spacesuits at the base of the catwalk. Jen and Edward and Cantu and Zheng—the last all encouraging waves in the absence of knowing what to say in English. John waved back. Without looking down, he registered the gleam of the dish, photons reflected toward

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

where he was going now.

When he stepped onto the antenna platform, his knees buckled. He sat down with an undignified little bounce.

"That's it!" Jen cheered. "Take a breather! Look up," she suggested.

"Where is it?" asked Cantu.

"There, in the Small Magellanic Cloud, but the supernova is still too faint to see with the naked eye," Jennifer answered. "Bear in mind that the Cloud is a galaxy of stars. A few weeks from now the supernova will be outshining the rest of that galaxy."

Incalescent—two hundred and fifty thousand years ago and away—SN 2013C was the signal flare of a vast cataclysm, in which a giant star blew up hot as hell. No: hot but not infernal. Hot as heaven, hot as the forges of heaven. Heavy elements were being created in the supernova, iron and gold, carbon and oxygen, the atoms of which Moons and moonsuits, Earths and living things were made.

He picked his own personal collection of atoms up and walked to the equipment housing. Carefully he lifted the broad aluminum lid and locked it into open position.

Jennifer asked, "What *is* the problem?"

Thumb to forefinger, he plucked sheets of clear plastic off the circuitry. "The contractors left the protective sheathing on."

Jennifer transmitted an unladylike curse having to do with the contractors, and what else they might have been capable of forgetting to do.

"Oh, my," said Edward, "I don't think those gentlemen would quite forget *that*."

John had removed all of the plastic, and the equipment looked sharp and clean, solid-state of the art. He glanced at the gleam beneath the grated floor. "Rodriguez?" he radioed. "You down there?"

"I take it you won't be dropping in."

"Not today. How's it look?"

"The job'll hold for a few years, minimum."

"By that time, it'll be time for the Phase II enhancements," John said, with satisfaction. He closed the lid and, returning to the catwalk, hurried down to *luna firma*. When he reached the bottom, the other spacesuits clapped for him. "It's ready now," John said.

"But is your photon bucket going to work with a hole in it?" asked Cantu.

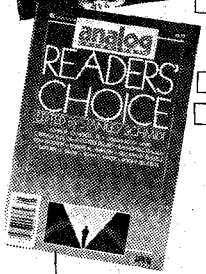
"Sure. Remember *Voyager*'s takeoff? The plane flew OK anyway. Something like that." Cantu might not have been born yet then, but John remembered watching it on TV, in December of 1986, the end of the year that began with *Challenger*. The experimental plane rolled down the California runway, loaded to the gills with fuel, and its long, fuel-laden wings flexed down, scraping the ground. The *Voyager* took off with wires hanging out of ragged wingtips where winglets had been scraped off. And the plane did not touch Earth again before it had circled the planet. It had not really needed the winglets.

Bolton did not really need the few segments that had been knocked out of it. John felt a stirring of euphoria, the old anticipation of having a dream machine to work with. It had been a long time since he felt that way: for months, he had stared at the diggings in the crater, thinking how little it all resembled

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

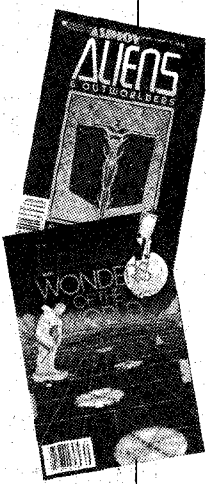
OUT OF THIS WORLD READING at an OUT OF THIS WORLD PRICE...

Explore the outer reaches of the universe . . . . be amazed and mesmerized with the stories of Science Fiction. Take the challenge now, and reward yourself with the exclusive collections of ANALOG and ISAAC ASIMOV ANTHOLOGIES that are available just for you.



ANALOG ANTHOLOGIES:

- ☐ #1 FIFTY YEARS OF THE BEST ($5.50)
- ☐ #2 READERS' CHOICE ($4.50)
- ☐ #3 CHILDREN OF THE FUTURE ($4.50)
- ☐ #4 LIGHTER SIDE ($4.50)
- ☐ #6 WAR AND PEACE ($4.50)
- ☐ #8 WRITERS' CHOICE (Vol. II) ($4.50)
- ☐ #9 FROM MIND TO MIND ($4.50)



ISAAC ASIMOV ANTHOLOGIES:

- ☐ #6 WONDERS OF THE WORLD ($4.50)
- ☐ #7 ALIEN AND OUTWORLDERS ($4.50)

Please send me the anthologies indicated.
I have enclosed my check or
money order for $ _____

Name _____

Address _____

City _____ State _____ Zip _____

Mail to:
ANTHOLOGIES
P.O. Box 40
Vernon, N.J. 07462

HTGC-3

Please allow 6-8 weeks for delivery.

For orders outside the U.S. please add $6.00 for foreign postage.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the first grand idea. Now, Bolton was ready to meet the ancient voyage of radio waves from the Universe.

Edward said, "I haven't finished checking out the computer and its interactivity with the rest of the system." Edward had a fresh contribution of rain for the parade. "I can't guarantee that there aren't any bugs lurking, and in fact by departing from the trial timetable—"

"Forget it!" John said shortly. "The time to try is now." And he started down the path to the control room, stirring up puffs of moondust.

"A radio interferometer—a chain of dishes strung across a continent, or an ocean, or even from Earth across space—can resolve finer detail. None have this aperture." He opened the window shutters. The control room was perched on the rim of Bolton, below one of the cable towers. He let his eyes follow the cables out over the expanse of the dish. Fifty acres. The antenna hung over the dish like a spider on a tricornered web fifteen hundred feet across. Behind the other two cable towers, the Sanduleak plain stretched away for gray miles. Starlight faintly reflected from LFSVLFA like a metallic hint of waves in Sand Lake.

"Human activities on Earth generate an incredible amount of radio noise, swamping the faint signals from the Universe. Located here, the dish as well as the Very Low Frequency Array are shielded from the radio noise of Earth by the bulk of the Moon. I might add that the Moon itself is dead quiet apart from very rare rock electric discharges. No weather—no lightning, no seismic activity. For radio astronomy, there is no better place than this. Here goes." Displacing Edward from the controls, John entered a right ascension and declination.

The red lights flashed at the corners of the distant antenna platform. John flashed back to being there, to the panicked realization that the platform was slewing out from under him. Arms crossed, John watched the antenna move. Unlike Arecibo, there was no whir and vibration from the machine. This one repositioned silently.

"First off, not the supernova," John explained. "Instead we'll scan something called Centaurus A. It's a radio galaxy, a blazing strong source in the radio sky. This is to verify that the receiver's working. Like making sure your new home stereo can pick up the local pop-around-the-clock music station before you go for the university radio station, the one with a weak and unreliable transmitter located ten miles away." He had an afterthought. "Edward, can you convert the signal to sound?"

"Whatever for?" Jen said.

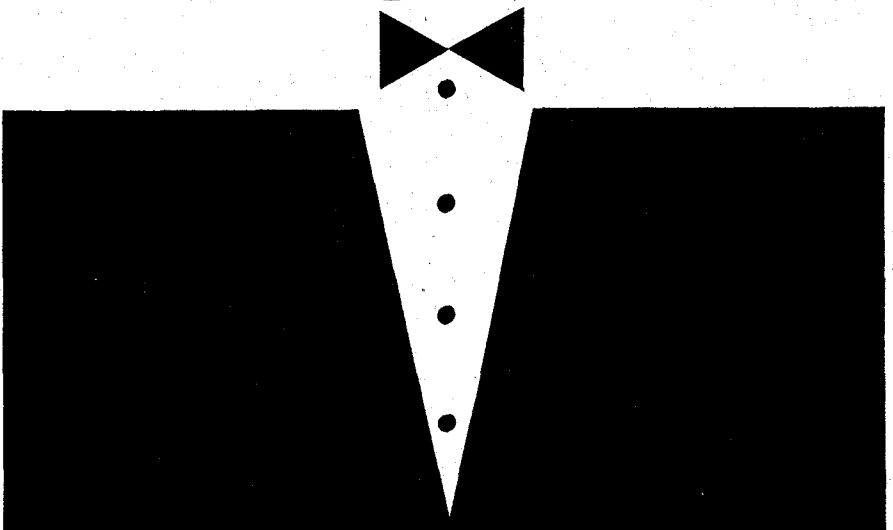
"Show and tell for our company." John explained, "Radio astronomers never listen to the stars. It's not informative for scientific purposes."

Methodically, Edward made the arrangements, hitching this circuit to that.

The antenna slid slowly now, smooth as silk on glass, gliding past the point where the radio waves from Centarus A were focused by the reflector, for a drift scan. On the vidisplay screen, the signal came in with what looked like the lift of a bell curve. Converted by Edward's arrangements to sound waves, the signal hissed.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

THE WORLD'S LEADING MYSTERY MAGAZINE
ELLERY QUEEN'S
MYSTERY MAGAZINE



THE BUTLER DID IT?
STAY TUNED...SUBSCRIBE NOW
AND FIND OUT WHODUNIT!

THE WORLD'S LEADING MYSTERY MAGAZINE
ELLERY QUEEN'S
MYSTERY MAGAZINE

P.O. Box 7052
Red Oak, IA 51591

☐ Please send me 18 issues of ELLERY QUEEN'S MYSTERY MAGAZINE for only $26.97—I save 29% off the basic price.
☐ Please send me 12 issues for only $18.97. I save 25% off the basic price.

Name_____
Address_____
City_____
State_____ Zip_____

MTSC-2

Please allow 5 to 8 weeks for delivery of first issue. Outside U.S. and possessions $25.97 for 12 issues 18 issues for $38.97. All foreign orders must be paid in advance in U.S. currency.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Sounds like static to me!" Cantu remarked.

"Sweetest static I've ever heard!" John replied fervently. The hiss crescendoed as the bell curve tipped over on the vidisplay screen. "Jen, just look at that curve! That's classic!" The computer brain of the observatory, buried deep under the lunar ground, analyzed the signal. Data windows lined the top and bottom of the vidisplay screen. He tapped a window, opened it to read out the red shift of the radio galaxy. "This is great. This is instant gratification. The machine works! Jen, let's break out the champagne!"

"Coming!" She opened the locker with a cheerful rattle.

Then John entered the coordinates of SN 2013C and changed the control settings. "This time, no drifting. The signal, if any, will be too faint to catch unless we sit on it. We'll be looking for thermal radio emissions at a likely wavelength, six centimeters. Don't be surprised if we register, and hear, nothing."

"Cannot be much yet!" Zheng said. "But is good this working!"

"Absolutely, and we're going to celebrate. Champagne, anyone?"

Outside, the antenna slewed to its new position. Sitting in the master chair, John ran a hand lightly over the controls. User-friendly, he thought with approval, lucid, thanks in part to design changes that he had insisted on. "We're in position. We'll give it some settle-down time."

Poured into plastic glasses, the champagne fizzed. The sound conversion hissed just as faintly, pale noise that originated in the circuitry.

"Nada," remarked Cantu, not too worried. Champagne in one hand, he accepted a piece of the chocolate that Jen was offering around in the other.

John thumbed through the supernova report. Thirty hours old, SN 2013C should be brightening rapidly as it began to expand, on the verge of blowing its outer layers off, but still, in fact, intact. Realistically, there was no radio signal to be expected yet. At least not from 2013C.

John said, "This machine has state-of-the art timing. Routinely, the receiver averages out any fluctuations in the signal. But a signal can be too faint to detect when it's averaged like that. So I'm going to delete the averaging, in order to search for a coherent, pulsed signal with a period of one to ten milliseconds between pulses."

Jennifer raised an eyebrow.

"Do you still want it converted to sound?" Edward asked.

"Yes. If we get anything."

"What's going on?" asked Cantu. "Making sure the corpse isn't spinning in its grave yet?"

"Actually, we don't have the resolution to distinguish a pulsar at the exact location of SN 2013C from one in the vicinity." John watched the bubbles in his glass. They rose slowly, just as things on the Moon fell slowly, giving you time to think. "Most stars aren't solitary. There's no reason for the supernova not to be in a binary star system—with a pulsar left over from a supernova ages ago, maybe even a millisecond pulsar."

"Unlikely," Jennifer commented.

"But very desirable," he countered. "Millisecond pulsars are the most ac-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

curate clocks in all creation. If we had one in the vicinity of a supernova in progress, we could observe what happened to the timing as the pulsar got hit by gravity waves, radiation, maybe plasma from the supernova. Also, the amount of mass lost in the supernova—and whether or not it breaks up into more than one body—that would register in the signal from a pulsar in the right location. And Bolton is more well equipped to read such a signal than any other facility on the Earth or off it. Right, Jen?"

"Yes, but the pulsar is still darn unlikely to be there," said Jennifer. "Has the champagne gone to your head already?"

"Serendipity happens," John pointed out.

Under the rim of the crater, the big dish gleamed in the faint rain of photons. The receiving instruments caught a unique radio thread; the computer teased it out of the background circuit noise. Edward promptly converted and amplified the signal. It came out as a conversation-stopping loud hum. Echoing from the bare walls the hum sounded startlingly pure, and made Jennifer leap up, spilling some champagne. "Edward! Make sure that's not our equipment!" she gasped.

"High C!" Cantu guessed. "Are you sure that's not little green men?!"

John said rapidly, "It's consistent with a millisecond pulsar." With a glance, he verified that the vidisplay screen was representing the signal as a series of spikes. Data windows lined up under the running spikes. John opened one window and read the period of the signal: two point one thousandths of a second. "I think we've made a very timely discovery, thanks to you guys helping us fix the dish."

"Hot damn!" Grinning from ear to ear, Cantu pumped Rodriguez's hand, then Zheng's.

Jennifer was too surprised to be jubilant. She asked, "What ever made you look for it right away?"

"I read over the previous data last night, and slept on it." John smiled. "And then I dreamed about a hummingbird. It was humming, just like this." He turned both palms up in the bright flurry of sound echoing around the room.

"I'll be darned!"

John laughed.

Edward solemnly announced, "I can't be *absolutely* sure it's not the equipment, but it seems unlikely," whereupon Jennifer bounded over and kissed Edward. Then she said, "Let's let Schropfer know!"

John nodded. "And Ramona."

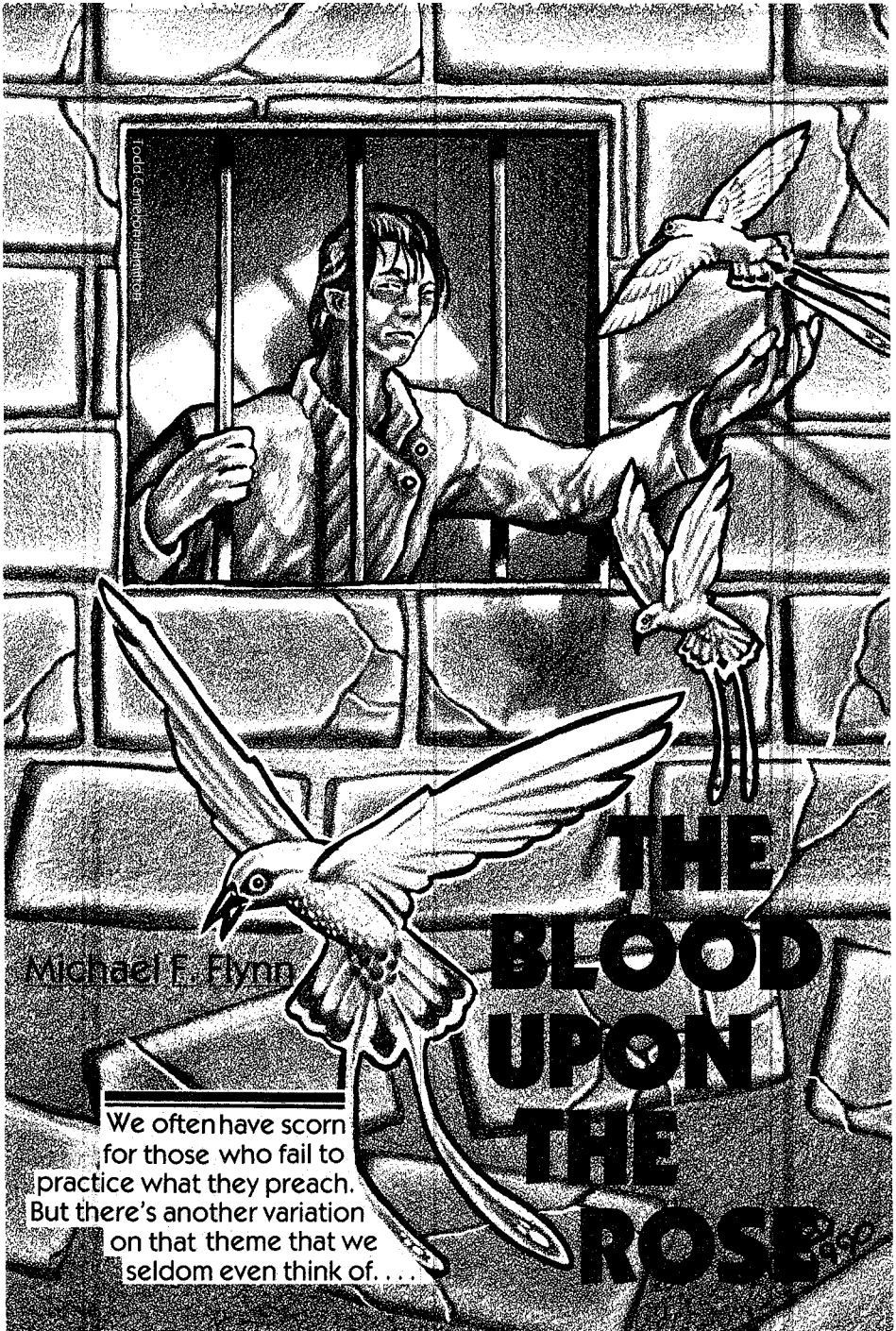
"Of course."

Ramona would want to hear about the hummingbird dream—she would be delighted. But that was a gift to save until he saw her in person again. "She knows enough astronomical nomenclature to understand this." He sent the same brief message on its way to the L-5 space station as well as to Washington, DC, Earth. The photons of his message traveled to L-5 and to Earth at the same speed of light with which the pulsar's signal had crossed intergalactic space to meet the radio telescope on the Moon.

PSR 0106-73

IT WORKS ■

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



THE BLOOD UPON THE ROSE

Michael F. Flynn

We often have scorn for those who fail to practice what they preach. But there's another variation on that theme that we seldom even think of. . . .

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

They showed her into the grey stone prison and led the way to his cell, treating her with cold politeness. Politeness, because she was after all the daughter of Elder Praisegod Johnson, entitled to a few privileges; and because, in all fairness, she had been convicted of nothing herself. Equally important, she had been accused of nothing. At any rate, of nothing worse than poor judgment in love. And love, as they say, is blind to the faults of the beloved.

But the beloved in this case was the notorious rebel and heretic, Sebastian Jack, caught at last after lo these many years of fruitless search. Caught, accused, condemned. Someday, in a more reflective mood, the state might even find time for the trial. Just for the record. There was no doubt the man was who he was; no doubt that he had done what he had done. Nay, he even bragged of his deeds. He had printed leaflets of the old secular humanist Constitution. He had planned and executed the notorious raid on the Jericho arsenal. He had killed five proctors with a car bomb in Bethlehem. Given that the truth was already known, of what purpose, then, a trial?

And so, the coldness behind the polite smiles and bows. Even a woman, after all, should show better sense in friends.

Stone walls do not a prison make; nor iron bars, a cage.

Ah, but they surely do help.

Sebastian Jack's cell was high in the northeast tower of the prison they called God's Scales, a gloomy, dark stone keep that brooded over the pale Potomac ruins. This was only prudence where so important a prisoner was concerned. At ground level, a man might jump and run; in the dungeon, he might burrow. But from the pinnacle there was no escape save that a man grew wings and flew with the birds.

He was standing by the barred window, watching those selfsame birds, when she entered. The solid steel door closed behind her with a metallic crash, and she flinched a little from the sound, noticing the odd little detail that he did not. The cell stank, as the whole prison did. She saw the thin mattress laid upon the cold, stone floor. The rude, wooden stool. The honey pot in the corner, the source of the stench, unemptied in who knew how long. She fumbled in the purse they had searched and let her keep, and pulled out the deodorizing spray. Even the guards, insensitive as they were, carried spray cans to ward off the ever-present miasma of the prison. As for the prisoners, what did the stench matter? Few survived long enough for it to matter; and for those who did survive, it was no worse than they deserved.

"Sebastian?" She sprayed the mist into the air around her. She sprayed it at the walls and ceiling and, from a discreet distance, at the honey pot itself. The odor of pine and woodland flowers suffused the cell, incongruous in the barren, stone room. "Sebastian?"

He did not turn around, but reached out and grasped the window bars. "Mary, why did you come?"

"I wanted to, Sebastian. It was my right."

A short pause. "Yes, they are very

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

careful about rights. Those they have left us."

"Why won't you turn around and look at me?"

When, after a heartbeat, he did turn, she sucked in her breath. His face was a massive bruise. Purple welts closed the left eye. His cheeks and lips were swollen. When he smiled, she saw that two teeth were missing in the front. "Not so handsome any more, am I?"

She went to him and put her arms around him. "My love is not so thin as that. I don't care what your face looks like."

He pulled from her embrace. "Thanks," he said wryly.

"I didn't mean it that way." Mary knew she sounded like a petulant child and that that would irritate him. She reminded herself that he was going to die and why. "I mean I will always love you."

"For another twenty-four hours at least."

"Forever. I know who you are and I love you. I don't care what they say you did."

He twisted his lips together. "No, you don't care what I've done, do you? You are the daughter of the junior senator from Kentucky. You think that God's in His Heaven and all's right with the world." He turned and grasped the bars of his window and gazed outward at the freedom of the birds once more. "Well, I don't. Those people out there. Once upon a time, they were Americans. They knew what freedom meant. They could say what they pleased and not worry that a proctor might hear them. They could chase a president from office if they took a mind to."

"The Old Days, Sebastian. It's all stories. No one alive remembers those things. It's all different now."

He turned from the window and faced her with his arms crossed over his chest. He shook his head slowly, from side to side. "Oh, yes. It's all different now. Thanks to the Reverend Sawyer." He raised his voice, ignoring the hands she held up to stop him. "The Reverend Phony-Clone Sawyer," he shouted at the walls. "It isn't even Him, any more, you fools. It's His clone. He isn't a goddamned immortal!"

"Hush, dearest. That's blasphemy!"

He laughed. "What can they do? Execute me twice?"

"Oh, Sebastian." She let her hands hang by her side and dropped her head. "I did not come here to talk politics."

"No." His voice was heavy with regret and relief. "You never would talk politics." Unspoken, the phrase echoed: *Because, if you had . . .*

"I just wanted us to spend this last time together." She held her arms out to him again and he stepped into them.

"And I, too."

"I only wish it were more than tonight."

She felt the earthquake of his laugh. "And I, too."

"Let's not talk of the morning."

"No, let's not. If there is to be no future, of what use then to discuss it?"

The thought of his coming death distressed her more than she had thought possible. She reached up a hand. And let it drop. "Please, Sebastian."

He pushed her away slowly, but firmly. "Why did they let you see me? Did they hope you would turn me around? What did they ask you to do?"

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Sebastian, it is not necessary for you to die. You could . . . "

He laughed again. His laugh had always caused shivers in her back. "I could what? Recant? Go on 3V and tell the world I was wrong?"

"Yes. Live a while longer. I don't want you to die."

He took her by the arms and held her away from him. "I don't want to die, either. God above knows I want to live. But what does it matter? Even if I did what you want me to do—even if I recanted everything. I would only live long enough to make the videotape. I can't trade my principles for a few more weeks of life. What is life without honor?"

"What is honor without life?"

Sebastian Jack heaved a sigh and sank down upon his mattress. He sat on his haunches with his hands folded into a ball before him. "Oh, Mary, you don't understand."

"I know I am only a woman, a Frail Vessel—"

"No, it's not that at all. No one understands any more. They've forgotten. That's why we formed the Sons and Daughters of the Revolution. To put the stars back in the flag, where they've stuck their star-cross-and-crescent. To remind them of everything that once was."

She made two fists of her hands. "How do you know what once was?"

"I've read the books. Old books. Forbidden books."

"Forbidden because they contain errors."

He shook his head once, violently. "No! Because they contain the Truth. Freedom. Individual choice. The right to be secure in one's property. To speak and publish as we please. The right to bear arms. The right to privacy and our own bodies. The right to peaceably assemble and petition for redress of grievances. Those are not errors!" Then, louder, toward the thick, barred door: "We hold these truths to be self-evident: That all men are created equal. That they are endowed by their Creator with certain unalienable rights. That among these are life, liberty, and the pursuit of happiness!"

She went to him and hunkered down beside him. The paving flags were hard and sharp on her knees. She saw the tears inching down his scarred cheeks and took one of his hands in hers. "But we do have freedom of thought in this country," she reminded him. "You can think anything you want."

"You just can't say it aloud," he said loudly. "That was how it started, even before Sawyer. When the courts decided that Mormons might not practice polygamy; or Indians, the peyote ceremony. They could believe in it, but they must not do it." He shook his head. "Your regime only built on a foundation of rot that was already lying there."

"It is not *my* regime."

"Your father's then. You never questioned it."

"Should I have? It is a regime that has given us so much."

He gave her a look of disgust that froze her heart. "They have given us nothing and taken it all. Once, we had the planets within our grasp. Once, we had it in us to produce such a wealth of plenty that no one need starve or go in want. Nanotechnology—"

She gasped. "Was a blasphemy in

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the eyes of God!'' She stood and stepped away from him. ''Sawyer and Rifkin and the other prophets saw that. The Old Regime that you worship . . . they were Secular Humanists. They believed in Evolution and Capitalism. They blasphemed God and His Church. They polluted the Fragile Earth with their Demon Technology. Your nanotech is well forgotten. It was a Pandora's Box. Horrible things were done. To people, to animals.'' She shuddered. ''They say some people *became* animals. It would have destroyed the world. That was blasphemy, wasn't it? Blasphemy against the environment, just like Reverend Sawyer preached. In The Book, it says that God made us stewards over the Earth, and what steward lays waste to his charge?''

He rose from his mattress pad and turned his back on her. ''Why do I love you?'' she heard him ask. ''We always argue. Nanotechnology isn't completely forgotten, even today. Otherwise, how could Sawyer have cloned himself? We had the power to assemble and disassemble any material, molecule by molecule. . . .''

She went to him again and put her arms around him from the back. She felt how his bruised flesh cringed from her touch. ''Let's not talk of that. There is no point to such talk.''

He released a long slow breath, like a balloon deflating. ''Ah, no. There is not. But my death—''

''Hush, dearest! I want you to speak of nothing but our love.''

''Why?''

''Because they are going to kill you.'' The words were hot, almost angry. She saw how they hurt him and regretted it immediately. ''I don't understand why you have to die. You could have kept quiet. You could have lived your life—''

''As a slave.''

''With me. Is that so terrible?''

''No, for I do love you, too. You don't understand me, Mary. I serve a cause larger than either of us.'' She saw how his hands shook and marveled at the bravery that graced him in the face of such fear. ''Some things are more important than life itself,'' he finished.

''Yes, love.''

''Love of country.''

''Your country doesn't love you. They curse you for a terrorist.''

He smiled bitterly. ''Unrequited love, then. The purest sort.''

''Do I mean so little to you?''

''Never. But I am a patriot, and my country needed me.''

''To die. But I need you, too. I needed you to live for me. And now I can never have you.''

He nodded. ''Yes. It is too late for that.''

She bowed her face against his chest. ''I know. Too late.''

''I only regret that I have but one life to give for my country.''

''A fatuous expression from a forgotten book. Patriotic posturing. What is worth dying for?''

''Freedom.'' His words were defiant. ''To be able to say what I wish. To go where I wish. To worship God—or not!—as I please. That is worth the greatest sacrifice.''

''Your life. That is not the greatest sacrifice.''

''No? What is?''

She would not answer him. ''And so useless.''

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Not if it awakens the masses. To sacrifice one's own life is the hardest thing of all; but if my death becomes a symbol. . . ."

She buried her face against him. "But it will not. Most will never know of it. And those who do will say you received no more than your deserts. For the masses to rise, they would need a grander symbol than that."

He took her by the chin and tilted her face toward his. "Oh?" He smiled in self-mockery. "And what would that be?"

She smiled sourly. "If God's Scales itself were to collapse into rubble. . . . If these stones were to tumble like jackstraws, and this fortress vanish. . . . Then might they rise up."

He laughed. "I shall beat my fists against its walls until it does."

She turned her mouth up to his. "Kiss me. It is all I will ever have of you."

He gave her the rakish half-smile that always made her heart flutter. "The proctors are watching."

"Let them," she said. "I can take my flogging and wear the stripes with pride."

He held her close and for a moment she let herself float in his arms. Across his shoulders she could see the window and the birds beyond. Ah, if only he could fly with them . . . !

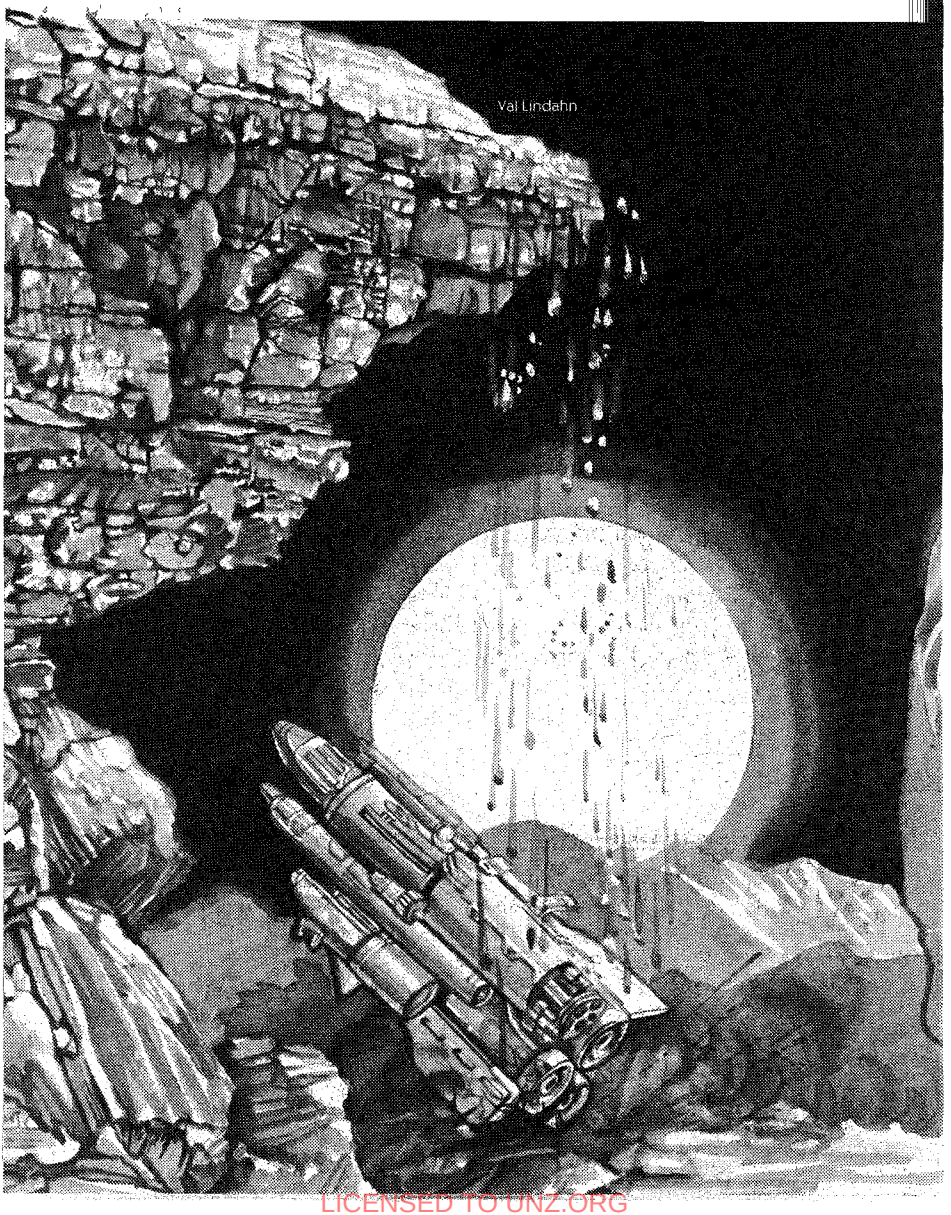
"I love you Mary Rose Johnson," she heard him say.

"And I love you, Sebastian Jack."

By early the next day, when the sun's first rays had stained God's Scales a dusty rose, the nanomachines she and the other women had sprayed upon the walls had done their work; and the building collapsed in a cloud of rubble, taking all: proctors, guards and prisoners alike, into ruin beneath it and Sebastian Jack, for a few brief moments flew at last among the birds. She wept then an ocean of tears. When all the sorrows had fled Pandora's Box, left behind was hope; and even hope could be a sorrow. She could not tell him now what she had always kept close in her heart. That patriotism need not speak its name aloud; that silence was oftimes the bravest act. And that sacrificing one's own life was not at all the hardest thing to do. ■

Customer Service or Subscriber Assistance
Please direct all changes of address
and subscription questions to:
Analog Science Fiction / Science Fact
P.O. Box 7061
Red Oak, IA 51591

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

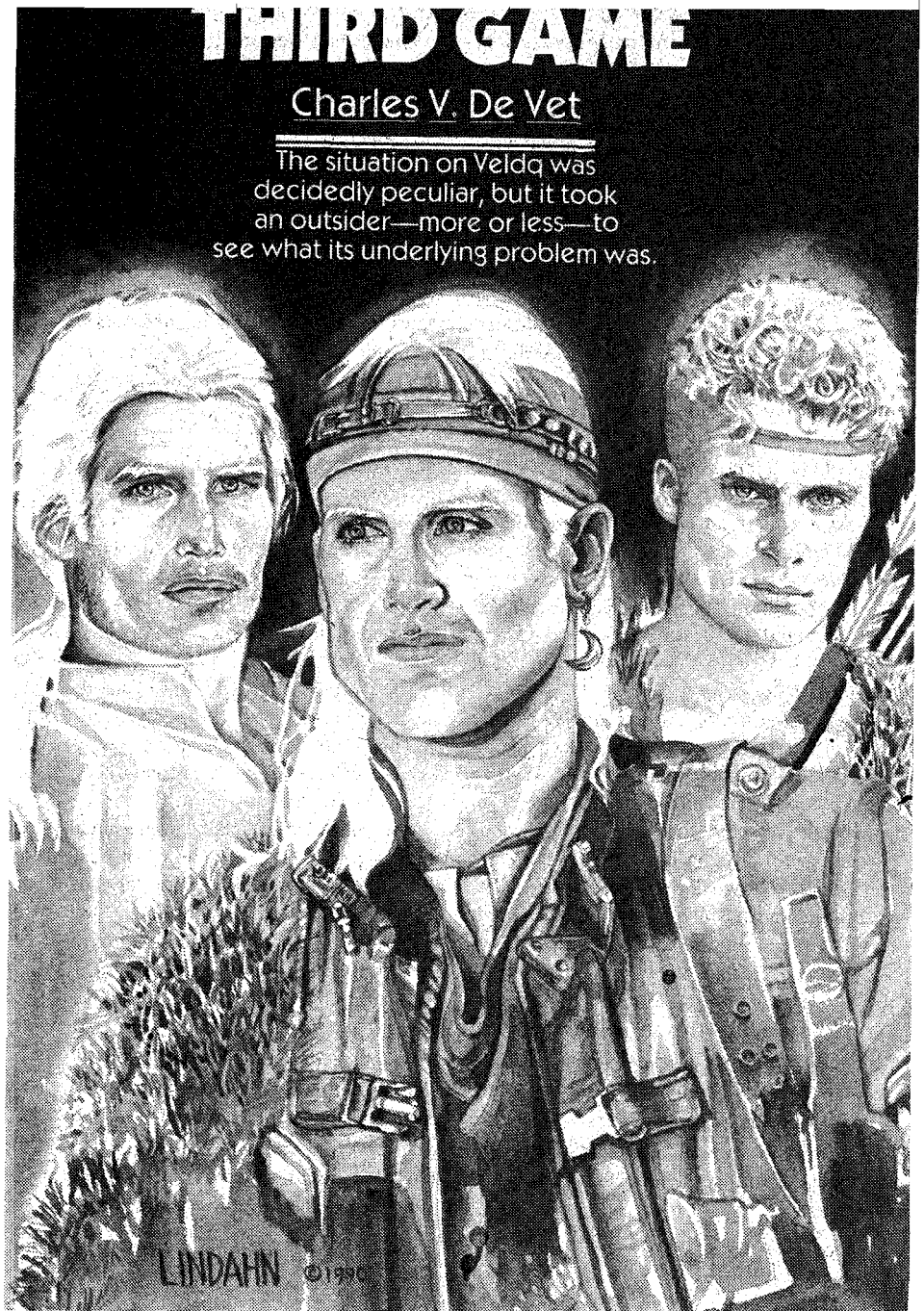


LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

THIRD GAME

Charles V. De Vet

The situation on Veldq was decidedly peculiar, but it took an outsider—more or less—to see what its underlying problem was.



LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

We waited for several more hours. Both Trobt and I glanced often at the green mottled baseball of a world on the vision-master screen. It was Trobt who first pointed out a small, barely discernible black spot on the upper right rim of Quagman.

As the hours passed and the black spot swung slowly to the left, as the planet revolved, it grew almost imperceptibly larger. When it disappeared over the edge of the World we retired. I did not sleep.

In the morning the spot reappeared, and now it covered nearly half the face of the planet. Another ten hours and the entire World became a blackened cinder. Quagman was dead. The Veldqans had inarguably demonstrated their battle superiority. With a single weapon.

Two days later the Human Worlds surrendered.

From SECOND GAME

By the time the first tentative fingers of the storm enveloped the space shuttle Kalin Stranberg and his two Veldqan escorts were already encapsulated in their protective cocoon. Soon high winds began buffeting the small vessel, at times overwhelming its automatic controls and pushing it northward, though they were never able to disrupt its gyroscopic balance.

Until it brushed against a rocky ledge that tore a hole in its plastic skin. The crippled vessel turned on its side and drifted slowly down the mountain ridge, to a sandy plain at its base. Hurriedly the three men unzipped their snug envelope and worked their way out of the ship.

Where they were met by a party of seven clansmen, clad in rough animal hides—and holding short bows at alert.

After a moment of indecision Vassan, the taller of the two escorts, went over and addressed a clansman at the head of the party in a dialect unfamiliar to Kalin, apparently explaining who they were and why they were here. Once the clansman glanced at Kalin, and shook his head.

Vassan said something further, and the other answered, and for several more minutes they conversed—Vassan with many arm motions, the clansman stolidly quiet.

"What are they talking about?" Kalin asked Barzr, the second Veldqan escort.

"Vassan is arguing that your life should be spared," Barzr answered. "The possibility is small."

The words caught Kalin unprepared, shocking him with the abrupt discovery that his life hung in the balance. "Why would they want to kill me?" he asked. "I have done them no harm."

"We have invaded their home land, without permission. It is an act of hostility." Barzr seemed to consider that explanation enough.

"Do they kill for something so trivial?" Kalin asked.

"It is a matter of honor. They have been treated with disrespect and must have satisfaction." That seemed logical to Barzr but he saw that Kalin was still puzzled, and explained, "These are what you would call primitives. They keep to their mountains here, and are little changed by the new culture that

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

taints the city dwellers. To invade their territory without permission is an insult, deeming them too weak to defend themselves, being like children, and the insult must be wiped from their lips.''

''Would they kill you and Vassan also?'' Kalin wondered aloud. ''Or does their code apply only to outsiders?''

The question must have violated some Veldqan mores for Barzr frowned fiercely and turned his back.

Vassan returned then. He smiled and gripped Kalin's wrists firmly. ''They have heard stories of your father,'' he said. ''He is a great hero to all of Veldq. They risk the disapproval of their clan but they have agreed to spare your life.'' His face made a motion to smile again, but it never quite reached the surface. ''May you be worthy.''

Which was a vast relief. Kalin's concern shifted to his companions then. ''Will they spare you also?'' he risked asking.

Before Vassan could answer—if he intended to—Barzr stepped forward and gripped Kalin's wrists in his turn.

Both Veldqans walked a few yards away then and stood side by side, staring straight ahead. Two tribesmen raised their bows and shot arrows into their throats.

For the first time in his twenty-two years Kalin knew the agonizing frustration of being utterly helpless. There was nothing he could have done to save his companions, and nothing he could do to avenge them now. They had been men of courage, and their lives should not have been taken so wantonly. Though he admitted to himself that under their code the clansmen had done nothing wrong. Their only indiscretion might have been sparing his life. Nevertheless, it was a bitter experience.

Further, there was grave doubt now that he could complete his mission: to find the cause of the troubles that plagued this world.

The clansman who had conversed with Vassan stepped forward. He removed his greatcoat and wrapped it about Kalin's shoulders. It was an unexpected kindness. The garment reeked of clansman odor, but it was welcome. The evening had turned quite cold. The temperature must have been near freezing.

This world had only one continent —Kalin remembered his father telling him in one of their many discussions about Veldq—covering the northern third of the planet, with its temperatures ranging from sixty degrees Fahrenheit to several hundred below zero. The land mass merely touched what would have been a temperate zone. The distant yellow sun was even then sinking behind a mountain peak.

A clansman touched Kalin's shoulder and motioned him to follow the others, who had begun moving away while Kalin was lost in his thoughts. That might be his biggest handicap on this mission—he was a daydreamer and his attention was not always as alert as it should be.

He hurried to catch the clansmen, as they walked in single file along the foot of the grass-covered ridge. The night grew progressively colder as they walked, and soon they broke into a trot. Which Kalin welcomed. The exercise would bring more body heat. Further, it kept off most of the small black insects that

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

persisted in trying to get into the corners of his eyes.

He noted that the clansman who had given him the coat evidenced no discomfort. Was it an innate hardiness, or pride in displaying indifference to the cold? He guessed that it was a bit of both. He was apparently the leader of the clan group, and might need to show his fortitude.

Gradually the party increased its pace, until they were in a long striding run. None showed signs of tiring. The Veldqans, Kalin understood, had a historical background of long-distance running. Their ancestors had been raised under the threat of attack by dleeths, savage semi-intelligent beasts resembling huge polar bears, but with long necks and short-haired hides. Their menace had literally shaped the history of this culture. They had been too large and fierce to be fought with the simple weapons of the early Veldquans, and so powerful that few dwellings were safe from their onslaughts.

When a dleeth attacked, the family was forced to flee, making their escape through long tunnels prepared in advance. They could outrun the dleeths but required rest periods, while the dleeths were nearly tireless, diverted from the chase only when their voracious appetites forced them to seek less elusive prey, or the Veldqans reached a safe refuge.

Fortunately for Kalin he was half Veldqan, and had inherited the same redoubtable physique from his Veldqan mother. He was careful now not to fall behind or display any evidence of fatigue.

They ran until just before dawn, when a light appeared in the distance, and a clansman pointed and grunted a few syllables, and all turned and trekked back the way they had come, leaving Kalin alone. He was relieved to learn that their intentions were not hostile. Despite his lingering bitterness he was grateful for their help.

Kalin allowed himself the luxury of slowing to a trot, and as dawn changed to daylight found himself entering a forest of stunted brown trees, reminding him of the Kalahari bushman country of Africa. Actually a desert, but with the short trees everywhere he looked.

With dawn the light ahead had dimmed and disappeared. Now vines in the miniature trees impeded his progress, and he grew more weary than he had when running. He remembered then that he hadn't slept in nearly twenty hours, and found a grassy knoll and laid down, pulling his greatcoat tightly about him. He was asleep in minutes.

Some hours later he was awakened by something nibbling at his boots, and he chased away a scaled creature resembling a snake with legs. He went on, coming soon to another sandy plain. Ahead he could make out a mighty city, shrouded in cumulus clouds, with wide structures rising above a surrounding wall. The City, the Hearth, the Citadel—it had many names.

It was also called Homeplace, and named as such by all the clans. In ancient years a family expecting a child always sought the walled fortress for its birthplace. Cha Dan had been built by the Danlee clan in times dim to memory, and all families were welcome at birth-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

ing time, including those who at other places would be enemies. And thus all regarded it as the Homeplace.

The primal influence of the voracious dleeth again.

Kalin followed the red sand until he reached his objective, and stood a minute admiring the great city. On this closer inspection he could make out where later additions had been made to the original structure, and outside the walls as well. All constructed of a red stone mined from the ocean a hundred leagues away. The stone was malleable in the water, but turned flint-hard when dried.

The highest point of the City was the GAMES building, huge and impressive with its surrounding consorts rising to it in long waves, just as his father had described it.

His father, Leonard Stromberg, might have stood on this very spot twenty-three years before. A ship of the Ten Thousand Worlds Confederation had chanced on the planet and discovered the first aliens they had encountered in the galaxy. The Worlds had sought to establish friendly relations, but had been met with adamant refusal. They had sent a fleet of a thousand ships—offering the hand of friendship, while carrying a big stick.

The Veldqans had wiped out the fleet.

The Worlds had smuggled in Stromberg, the chess champion of his sector of the Worlds. He had learned the GAME (always capitalized) that determined government positions on this world. It tested their intellect, fortitude, temperament, and ingenuity. The method of choice was never questioned, and proved an efficient means of selecting leaders.

His father had set up a booth in a Fall Festival, with a sign that read, I'LL BEAT YOU THE SECOND GAME. Which he did. All comers, including Kalin Trobt, their highest official.

In time he and Trobt became close friends and the clans of Veldq made him a hero, the greatest enemy hero in their history. One man against a world, challenging their best, and beating them. A dleeth.

Yet he learned soon that he must die!

He had come to their world against their express wishes. The penalty was death. They would honor him, however, with the Noble death, where a man could fight valiantly, up to the height of his ability, and die only when he has expended all his strength and endurance. To the warrior race of Veldq that was the honorable death.

Stromberg had escaped his impending fate by offering to return home and try to persuade the Worlds to surrender. The Veldqans regarded that as despicable cowardice, only much later realizing that the capitulation had been inspired not by cowardice but foresight of a greater gain for both races. Despite their immediate scorn the Veldquans allowed him to return home. An honorable people does not grind the face of a supine foe.

Stromberg had not been able to convince the Worlds to surrender—until the Veldquans incinerated two of the Worlds, demonstrating their ability to, at the very least, inflict massive destruction. The decision was augmented by Strom-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

berg's argument that the Worlds would win the final victory.

China, he argued, a country of Old Earth, had been invaded and conquered many times, yet always won in the end by interbreeding and absorbing its conquerors.

In the same way the humans would absorb the Veldqans—for the races could interbreed. The odds against the interbreeding of alien races were tremendous, but the chance was always there, and in this instance the number had come up.

Since the armistice many other Veldqans had availed themselves of the opportunity to mate with human women. The fleshier the better, for to them the acquiring of avoirdupois was synonymous with desirability. By now the melding of the races was well under way. The Veldqans were aware that they were losing the Second Game, but could not stop. Their women were fertile only one year in eight, and were unable to satisfy the sexual hunger of the males. Consequently they eagerly sought human women—under a compulsion stronger than racial loyalty.

Trobt himself, in a surreptitious visit to a World, had brought back a human wife, and had had a child by her. Kalin Stromberg was the offspring of a human father and a Veldqan woman.

Kalin entered the City through a wide, unguarded passageway, with ornate gates swung wide, and followed the map in his mind, as he had formed it when his father talked. He was grateful to have inherited his eidetic recall.

From this inside view there was an air of somber mystery about the City, with its round buildings and black slate roofs, and its dozens of canals cutting across the streets like gray markings on a map. Ahead he could see the River Wid, which flowed through the center of the City, dividing it into two almost equal parts.

Beyond the east wall were neat farms and scattered homes, and a league away, the Great Slate Mountain, so dark that it pulled into itself the light and heat of the sun. It was there that the City got the material for the roofs and landfills. The few trees he saw were smaller than those on Old Earth, gnarled and crooked. The result of the violent storms he had heard about? The only fruit was something resembling large tangerines on one of the stunted trees. No birds or domestic animals showed themselves.

The streets were uncrowded, with no women in sight. The men and boys mostly wore garments with tube sleeves and legs. Kalin soon noticed that his own clothes were attracting attention, and he stopped in at a Kisman shop and exchanged his greatcoat for a native suit. The merchant seemed quite pleased with the exchange. The Kismen were the shopkeepers and craftsmen on this world, and regarded as a lower class by the warrior clansmen.

Next door Kalin purchased a meat-filled roll, paying for it with his signature on a pink slip, a normal trade procedure. It was actually a form of IOU, that in time would have to be redeemed. He ate hungrily, with great satisfaction.

He walked on as he ate, often having to step aside as three-wheeled vehicles swooped past. All Veldqans drove in gull-like sweeping curves, seemingly

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

with only casual attention, but seldom had accidents. Kalin found himself not only being careful to keep behind the blue pedestrian line, but flattening against the wall of a round building and pulling in his stomach as a car seemed about to careen into him. He resolved never to try driving one.

At that moment a woman approached, clad in a garment resembling the male suits, but made of a more filmy material. She walked with pride but without insolence, the most magnificently feminine woman he had ever seen. The Worlds had nothing to compare with her, he was certain. As she passed, and smiled at him, he caught a woman scent, so delicate that he wasn't sure it had been there. Yet his male glands told him that it was not something artificial but came from the pores of the flesh itself. It aroused a hunger, unbidden, and he wiped his moist palms on his blouse after she had passed.

The Veldqan woman has one fertile year in eight, when nature prepares her body for child bearing. In the other seven her feminine attributes atrophy, and she grows lean and muscular, prepared for flight from the dleeths. In the eighth year, a time called myst, her feminine charms reburgeon, she becomes fertile and makes her choice of a mate. Often without the male being aware of it, but always he greets the revelation with intense delight. There is a legend that only one man has ever refused a woman in her myst, and he was near blind and had an impairment of his nasal passages.

Kalin reached the GAMES building and followed a pedestrian rampway to the second floor. No one stopped him or seemed curious as he made his way to a large central room where perhaps fifty people sat on what appeared to be backless davenports, with broad curved tables in front of them. They worked on strips of vellum, marking them with dots and dashes, interspersed with short sentences. Briefly he wondered if a planet could be governed by such elementary means.

Kalin did not ask questions, but wandered about the room, glancing unobtrusively at each he passed—drawing no attention whatever. Until he became aware that he was being observed—and turned and met the curious gaze of the man he sought. Kalin Trobt.

Kalin Trobt, swordsman, intellectual, master of the GAME, first among equals on the Council. Trobt studied his face a moment, and stood up and came around his desk, with his hands raised palms forward in the customary Veldqan greeting. The gesture remained from more turbulent times—showing one is unarmed. The man had a long-boned frame, with almost classic features, and the intangible something known as "presence." Now, however, Kalin noted a lack of the vitality he remembered from their meeting nine years before. Trobt's movements were slower and more deliberate.

They met and clasped wrists in hearty greeting. "My namesake, Kalin Stromberg," the big man said. "You have matured, but your father's likeness betrays you. He could not come?"

Kalin shook his head. "He sends me in his place. I hope that does not disappoint you."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"In our correspondence he speaks highly of you."

"He flatters me."

"As I understand it, not at all." Trobt paused. "He could not come?"

"He begs forgiveness. In an emergency he will come with great haste. However, for now his mate is in myst."

"Only a fool would leave at such a time," Trobt said, in light jest, but obviously very sincere. The two men shared chuckles, and Trobt seemed to find a point of interest on a near wall, and studied it, until his attention returned hastily to Kalin. "I beg your pardon," he said, mildly embarrassed. Kalin recognized that the man's attention had wandered, and on closer inspection saw that time had leached a measure of character from the strong features. Trobt was aging.

"Do your human Worlds still harbor resentment toward us?" Trobt asked, obviously making polite conversation.

"There was great resentment at our surrender—ten thousand worlds kneeling to one," Kalin replied. "They see now that they lost only pride, and gained much."

"We have never been oppressive," Trobt pointed out.

"That is true. Most of us regard you as benevolent censors. Our conscience, as one commentator expressed it. Without you there would be quarreling, fighting, and diplomatic disagreements among the Worlds, as there was before the armistice."

"Another aspect—" Trobt's attention wandered a bit. "Common sense must tell you by now that our control is more in name than in actuality. If you had decided to fight us your numbers would overwhelm us, regardless of the potency of our weapons."

Kalin did not mention that it was whispered on the Worlds, but never made public, that they had learned the secret of the Veldqans's invincible weapon but did not reveal it for fear of upsetting the tranquility of both.

"We are happy to be friends of the Veldqans rather than enemies," he assured Trobt. "The Worlds recognize that they would lose more than they would gain by fighting you."

"To consider our present situation," Trobt introduced the subject of Kalin's journey. "In the last periods of our time we have had a series of troubles. Sometimes it is a shortage of food, a failure of transportation, or hostilities among the clans, who before had been blood brothers." He made a weary gesture with one hand. "At first we considered them isolated events, and dealt with them as such, but one trouble is always replaced by another." He looked about the room, as though viewing it for the first time. "At my age I'm not certain I understand everything that goes on about me," he said.

"Which is why you asked my father to come, to help locate the source of the trouble?" Kalin sought to cover for the aged statesman.

Trobt's face acquired an alert attentiveness. "You feel that there's a single source?" he asked.

It was Kalin's turn to hesitate. "I hadn't given it any conscious thought—that's just the way the question came out."

Trobt's gaze held steady on Kalin's face, weighing and measuring him. "You are being too modest." He pulled

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

a folder from a drawer and extracted a paper. "A letter from your father," he said. "Let me read a few lines: *I am proud of my son, a man now. There's a practical sense about him, an ability to see what others miss, to recognize relationships that borders on the intuitive.*" Trobt looked up. "Your father was never one to exaggerate."

"I suspect that what he sees is mostly a matter of lucky guesses," Kalin evaded, in some embarrassment.

"I would doubt that. But tell me exactly how you regard it." For some reason Trobt was intensely interested. "Is there no intuition involved?" he pressed.

"Intuition may be a part of it," Kalin admitted, wanting to be honest. "But I would say that it is more a meshing of observations by the subconscious, without my conscious mind having recognized them."

"Would it be possible that your ability to make those lucky guesses, as you call them, is the primary reason your father sent you, rather than coming himself?"

Despite his age Trobt was no shallow thinker, Kalin reflected. "If that is true he never mentioned it," he evaded again.

"Your father may have seen more than you suspect. We have a saying, 'To build a bridge one must have knowledge, to know where to build it one must have wisdom.' That wisdom may be what he saw in you."

Kalin found himself ill at ease at the compliment and did not answer.

"I will offer no suggestions," Trobt said. "It will be best that you are not influenced by our thinking—which has been without success. However, I would like you to see something of our troubles, if you will?" He took the acceptance for granted, spoke into a telephone, and afterward returned to Kalin. "Our conservation councilman, Cer Molonn, has been in charge of our investigations. He waits for you now on the roof." He looked about and spied a young man Kalin had noticed before, hovering in the background. "Swet-ein, will you accompany Cer Stromberg to the copter landing?"

The youth nodded and smiled at Kalin, as though telling him something. They turned to leave. Trobt, however, looked up and said, "Your father mentioned a man named Yondtl, I would presume?"

"Many times."

"He requests that you visit him. He is an intellect without peer. You would find a visit of interest."

"I will certainly do so." Kalin followed the youth out of the room and up a long ramp.

At the top they were met by a scowling man, as tall as Trobt, with a pink, wind-tanned face, and eyes bedded in deep pouches. Swet-ein introduced him as Cer Molonn, and stepped back, tactfully.

They nodded to each other and Molonn mentioned casually, "You will be working directly under me on this project. I am certain we will get on well."

Kalin hadn't expected that. Trobt had not told him of it, and he was not pleased. He sorely needed a free hand on this job. It was possible, he decided, that the man was assuming an authority he hadn't been granted. Here as on Old Earth men were ambitious, he suspected.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Molonn led him to a waiting helicopter, and they were soon airborne. The copter was automatic and swift, and they were over their destination in a matter of minutes: an extensive forest fire. "Our most recent trouble," Molonn explained sourly. "We have no understanding of how it started."

"Not from lightning?" Kalin inquired.

"We doubt it." Molonn did not seem inclined to expand on that. The copter had drifted to the right and the fire was left behind. Sometime later they paused and hovered over a macadamized road that had been built over a dried-out river bed, with high walls on both sides. "This was the scene of a disaster before the forest fire." Molonn pointed down to where a long stretch of the road was covered by a collapsed wall. "We found evidence of explosives there."

They discussed that for a few minutes, and Molonn set a control and the copter arrowed swiftly back to the roof top.

As they landed an explosion sounded from behind Kalin, and a section of the copter tail sailed past!

The next moment Kalin was lying on a bed in a hospital, with an attendant bending over him. "How do you feel?" the attendant asked.

Kalin stared up at him. The words had no meaning.

"You weren't badly hurt. Mostly shock. Your leg was gashed, but not too deeply."

Kalin looked down and saw that his leg was wrapped in a loose bandage. He lifted it. There was no pain.

"You can leave tomorrow, if you wish," the attendant said. "Cer Molonn was seated ahead of you in the copter, and was not injured."

Kalin nodded. In the background he noted the slim youth who had guided him to the rooftop. He was still tired, he closed his eyes and was soon asleep.

The following morning the attendant brought his clothes; after he dressed he was led to an anteroom. Swet-ein waited for him there.

They walked out together. "I will be your companion," Swet-ein said. Kalin noted how his voice was higher than he would have expected.

Undoubtedly Trobt had sent him. "I appreciate that," Kalin said.

"I have chosen you," the boy told him, his expression indicating that he was making a statement of considerable import.

Kalin was uncertain of the boy's expectations. "Thank you," he tried.

The answer was inadequate, apparently, for the boy grew quickly petulant. He might have been said to be pouting. "I will show you," he said reproachfully. "You will be so glad."

As Kalin remained uncomprehending the youth shrugged and asked, "Shall we go to my place of living? It will be yours also now."

"I'd like to visit a man named Yondtl first," Kalin responded. "Do you happen to know where he lives?"

The youth smiled in amusement. "He is our savant," he said. "I will take you there." They had walked a quarter of a block when Swet-ein excused himself and went into a large lot and returned with one of the three-wheeled cars. "Come into the side seat," he directed.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

When in Rome— Kalin climbed into the car and took a firm grip on the handle in front of him. They rode for several leagues, with the car swooping in and out of traffic, missing other vehicles so narrowly that Kalin held his breath most of the time. He had the suspicion that he was being given a more precipitous ride than normal—perhaps as punishment for the slight he'd unknowingly committed.

They came to a section of shops very much like those on many Worlds. It took a minute for Kalin to notice that the shop windows held women's clothing, exclusively. Swet-ein answered Kalin's unspoken question. "Selling places for the human wives of Veldqan men."

He angled the car around a half dozen children playing in the street. "Twixers," he said.

Of course. Children racially twix Veldqans and humans. "The boys and girls here play together," Swet-ein said, "and are not separated as Veldqan children must be."

Two blocks farther on they were jarred out of their equanimity by the sight of a male Veldqan body sprawled across a water main, with blood still dripping from his slashed-open throat. They slowed. On the ground beside the body were the words, HE RAN, obviously written in the victim's own blood.

Stark evidence that harsh warrior ethics still prevailed here. Neither spoke as they rode past and entered a wide section of rose-pink structures, with a massive crowd standing in the street chanting. They blocked the way and Swet-ein drove down a side street and around. "They worship nature's gods," he explained as he drove.

After another block they stopped and dismounted, and made their way up a brick walk to a red residence. The boy spoke into a round plate on the red door. "Kalin Stromberg, of Old Earth, comes to visit by Yondtl's invitation."

The door opened and a voice from inside called, "Enter!"

They walked in and found a bulky man with rolled up sleeves and hairy arms seated behind an ornate desk. Eyebrows joining at the center indicated that he was a Kisman. "You have come to challenge Yondtl, yes?" he greeted, his voice heavy with dogmatic self-assurance. "Everyone who comes here would challenge Yondtl, none succeed in besting him." The man's personality could be described as flamboyantly surly.

"Councilman Trobt said that you wished to see me," Kalin responded, suppressing an urge to turn and leave.

"Then you are welcome. Yondtl wanted to inquire about your father. Yondtl regards him as a friend. He is well, I hope?"

"Quite well, thank you." The savant was not a likeable person. There was something about him that spoke of conspiracy and treachery.

"Yondtl hopes you are enjoying your visit to our small planet. Is it business or pleasure?" His perpetual grin was irritating.

"That's still to be determined." Kalin was not inclined to humor the savant.

"It is dangerous not to know which side one is on." Yondtl's tone was tauntingly insolent.

"There are sides here?" Kalin questioned.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Yondtl guffawed. "Come," he ordered, and rose and led Kalin to a GAME board at one end of the room. Kalin noted from a corner of an eye as he followed that Swet-ein had found a place on a nearby couch, and now sat with folded hands, either awed by the reputation of their host, or repelled by his irritating manners.

"As the challenger you will have the privilege of the first move," Yondtl granted, still smiling stiffly.

By now Kalin had decided that the smile was built-in. Yondtl had been born without hands or feet, and without speech or hearing. After the armistice human doctors, with their advanced knowledge and skills, had corrected all the deficiencies and malformations. On his face they had probably had to resort to the permanent smile.

"We play the first GAME for feel," Yondtl instructed. "Yondtl will beat you the second GAME, as your father liked to say." He made a noise in his throat that might have been intended for a laugh. "Yondtl bested your father, you know?"

"Yes, he told me."

"Yondtl has never lost a GAME. He should be the first among equals, and not Kalin Trobt."

"Then why aren't you?" Kalin couldn't resist asking. While high talent is entitled to its pride, too much becomes arrogance.

"Because Yondtl is a Kisman!"

"There must be more to it than that?" Kalin persisted.

The only answer was that Yondtl's forehead wrinkled into a puffy scowl. "Play!" he ordered.

Kalin moved a pukt one square forward and two to the right—its value from that position. A pukt's movement is determined by its position on the board, rather than an intrinsic value.

Yondtl answered. Both made their moves quickly, and the contest was soon over. A draw. Despite the disclaimer, each had played his best.

Yondtl gave Kalin a close glance, and his manner grew less patronizing, though it granted little. "You will lose the second GAME, as Yondtl promised," he said.

The second GAME ended in another draw.

Yondtl's demeanor became one of casual disinterest. "Yondtl underestimated you," he acknowledged reluctantly. His blue blue eyes stayed on Kalin, searching for something there. Finally he pressed several buttons on the edge of the play board. The lighting shifted and a map appeared, probably of the City.

"You may be the first one capable of contesting Yondtl in this new game. It will try you to your depths, and beyond." Yondtl moved his fleshy face closer to Kalin's, ridiculing him. "To play it we each must anticipate what the other will do." He touched another button and the board became milky white, concealing the squares. Was there a computer involved here, Kalin wondered.

"Yondtl has moved a pukt, concealed by the white top. Now you will try to tell me which pukt it was. If you miss you will lose a point, if you are correct you will gain one. Then it will be your turn. Do you understand that?"

Kalin shrugged. "Certainly." Basically it had come around to intuition

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

again. So be it. He set his mind to near quiescence, waited for an inner feel, and made his choice.

Correct.

Kalin moved. Yondtl covered. Correct.

The game went on for only a short time—before Kalin pushed back his chair—in defeat. His correct assays had amounted to one in five or six—exceptionally good. Yondtl's had been roughly one in two. There had been no contest.

The man was a rare genius, Kalin was convinced by then. He remembered the high praise his father had had for him, and that, added to what he had seen here, was proof of an exceptional intellect. Yondtl deserved a greater scope of operations than this mundane tinkering at games. In his seclusion he utilized his genius only in an occasional contest with challengers, most of whom were not in his class. Including himself, Kalin admitted.

His father had said that Yondtl should be a Napoleon, conquering an empire, or an Einstein, delving into intricate profundities, rather than the so-called rose blooming in the desert.

"Pay me another visit whenever you like," Yondtl dismissed him. Swet-ein was waiting for him at the door.

"Be consoled with this," Yondtl called as they were leaving. "Intuition is not everything."

Kalin puzzled on that as Swet-ein pressed close against him. "I do not like that Yondtl," he said.

They noted at that moment three Kismen approaching Yondtl's residence. Their presence registered on Kalin's consciousness as being important, but no answer presented itself.

The Kismen also had been strongly influenced by the ancient presence of the dleeths. Or rather by their absence. The beasts had an almost phobic fear of water, and had never invaded the Kismen's island. Because of that their culture had followed a different track, without the machismo ethic of the warrior clans. Over the centuries many had migrated to the mainland and set up their shops and trading posts, and their numbers multiplied. The clansmen, while treating them with condenscension, recognized their utility and tolerated them. There was never any integration, however, no intermarriage or social contacts.

There was a grumble of thunder just before they reached Swet-ein's quarters, and the rain came down in sheets, soaking their clothes and bodies. They abandoned their car near the entrance, and ran laughing inside. Swet-ein stayed close to Kalin, as a quick camaraderie seemed to have developed.

The room they entered was round, with little furniture. Various-sized recesses in the walls held articles of clothing, and implementia of a household. On the floor against one wall was what had to be two zebra skins, and at the far end a modern kitchen. Old Earth and other Worlds utensils were in evidence.

They struggled out of their wet garments, and Swet-ein brought a loose wraparound for Kalin to wear. He noticed something then that caused him to figuratively stagger back.

Swet-ein was a female! Very ob-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

viously in the early stages of her Veldqan myst.

As he stood speechless Swet-ein saw his mental disarray and paraded her crypto-femininity, pushing forward her moderately elevated breasts, and stroking her expanded hips, as she pirouetted about the room. Her pubic hair was quite well developed, but was still the golden brown of a child. There was nothing prurient in her exhibition, she was as a little girl, playing at being an adult. Soon she too realized that, and chuckled, and left off her display. "You wait. You will be my slave," she promised with pseudo fierceness.

She remained nude, with no evidence of coy modesty, as she prepared two generous dinners—in a microwave. She ate daintily, but with good appetite, and when Kalin pushed away his half-empty plate asked, "Aren't you going to finish that?" Kalin shook his head, and she ate the remainder of the meal. "My myst," she explained, without apology.

That night they slept on the floor, between the zebra skins, with Swet-ein snuggled close, as though confiding herself to him.

Kalin lay long awake, with the attempt on his life strongly in his mind. How had word of his presence gotten around so quickly, and why would anyone want to kill him? He had too little information to hazard a guess. He dismissed the possibility that the bomb had been intended for Molonn. His final decision was to stay alert, but not to let his personal danger interfere with his investigations.

In the morning they decided to take a walk about the inner city. "Only afterward will we ride to the outside," Swet-ein decided.

They strolled in a leisurely fashion among the round buildings, observing little they had not seen on their trip to visit Yondtl. Except when Kalin asked if they had computers. Swet-ein shook her head. "The Council decided against them. They did not want to become too much like the Worlds." She realized that the words might be offensive, and touched her shoulder to Kalin's. "Too fast would not be good, they think."

Kalin had made no decision on that as yet.

"I will show you what we have in one place." Swet-ein informed him, eager to be of help. At heart she was a simple girl, unsophisticated, and very sweet.

The means of communication shown at the bottom of a flight of steps was nothing more than telephone switchboards, automatic. That should be quite adequate, Kalin decided, for a world no farther advanced than Veldq. In time, however, the culture would progress to a more complicated state, as with most of the Worlds. That would be time enough to bring in the computers.

One observation puzzled Kalin. "When my father was here there was a River Wid running through this underground, that carried away most of the City's waste. What happened to it?"

"It's down below now," Swet-ein answered, and led the way down another stairway. Halfway to the bottom she stopped. "You can see it all from here," she said.

The place was one enormous sanitation plant, Kalin saw. The River Wid was visible only at the rear exit, with

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

its water almost sparkling clean. "What have they done to this place?" Kalain asked, in considerable bewilderment.

"They dropped the ground level," Swet-ein took pleasure in informing him. "The telephone central is where the river was before."

In the exchange building, and as they walked, Kalin had noticed a succession of Worlds's influences: electric lights, curbing drains, fire hydrants, and police alarm boxes, that hadn't been here in his father's time.

Which brought an abrupt consideration, so startling as to seem a revelation: the troubles might not be the miswork-ings of individuals, but the revolutions of a major cultural change.

The absorption of the Veldqans's culture by that of the humans!

The ramifications were nearly overwhelming. This was not something to be glibly analyzed, or cured with simplistic solutions. There was much more here that he had to understand before he could arrive at any possible solutions.

Kalin had a hard moment of doubt. Did he have the ability to cope with anything so vast and intricate? It could very well be beyond his mental capability. He did not know. Youth needs time to make its personal assessments.

He would certainly try.

They took their three-wheeler from its lot and rode through a back gate into a section of houses and commercial buildings that had overflowed from the fortress and out along the River Wid. After awhile they came to an amusement park, with acres of games, exhibits, and rides. Most were strange, as one childrens' ride on low-slung animals that moved on traction undersides, and a bloat-fish that lived in a pressurized tank that performed acrobatics on command. It must be quite intelligent. There was no way for Kalin to determine which were native and which imported from the Worlds. With the vast variety of environments on the numerous Worlds most of them would seem strange to him.

At one point in their ride a parade of male juveniles, all stripped to the waist, passed in front of them. "They go to their puberty rites," Swet-ein said. "The ones who are not strong will die." A means of keeping the race fit, by eliminating the weak and the inefficient?

In the early afternoon they stopped at a small lake where they rented a cushioned raft and joined others on the water. There was no motor or oars but the raft rode low and they paddled with their hands, splashing each other often, but enjoying themselves.

On the far side of the lake they spied a large establishment with tall poles in front, and a sign reading, *Silver Spires Restaurant*. At Swet-ein's request they tied their raft to a pier—among a hundred others—and went in. The place was spacious, but so crowded that they had to wait in line for a table. Once seated, however, there was no delay. They punched in their orders and a few seconds later round sandwiches slid out in front of them. They greatly resembled Old Earth hamburgers.

Swet-ein was eating her fourth burger when an overweight but affable gentleman came to their table and bowed ge-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

nially. "My name is Vito Tamari," he said, extending a hand.

"Kalin Stromberg, and this is my friend, Swet-ein," Kalin replied, taking the extended hand.

"Your name, and the fact that you didn't grip my wrists, tells me that you're from one of the Worlds," Tamari said, very friendly. He was an easy man to like.

"Correct," Kalin agreed. "I'm from Old Earth."

"Then we may be distant relatives," Tamari suggested, goodnaturedly. "My home planet is Aldano, in the Crow Wing nebula. Colonized by Italians from Old Earth."

"Interesting," Kalin went along.

"I own this restaurant," Tamari said. "I have a franchise from the Silver Spires Corporation. This is their first restaurant on Veldq. I hope you enjoyed your meal?"

"It was delicious," Swet-ein assured him, wholeheartedly.

"I'm glad to hear that." Tamari's attention returned to Kalin. "I'm also a vice president of the corporation," he said. "We have a chain on 174 planets, over 40,000 in all." He waited for a reaction from Kalin, who remained noncommittal. "I'm empowered to grant other franchises," he continued. "Would you be interested?"

"I know nothing about the restaurant business," Kalin protested.

"We'll train you. And supply everything you'll need, including the building—and a manager. All you'd have to do—"

"I'm missing something here," Kalin interrupted, a suspicion forming in his mind. "Why did you pick me? You know nothing about me."

"I know more than you might suspect, Mr. Stromberg," Tamari answered, making a pretense of mild embarrassment. "In our business it's necessary to keep our fingers on the pulse, so to speak." He paused, and emphasized, "You can name your own salary."

Kalin's suspicions grew. "That sounds very much like a bribe."

Tamari's composure remained unperturbed. "I'll be frank with you," he said, very earnestly. "We were able to start this restaurant only on a trial basis. To establish a chain on Veldq we need friends in high places. To state it bluntly, we need you."

"Mr. Tamari," Kalin said evenly, "I have a strong aversion to doing business with people who offer bribes."

Tamari's smile remained in place. He glanced at his wristwatch, and stood up. "I'm afraid that another appointment presses me for time, Mr. Stromberg. If you'll excuse me." His words were courteous, but his manner was not.

As Swet-ein finished her last hamburger Kalin realized with amusement that she was still a juvenile when he saw her wet her forefinger with her tongue and use it to rescue the last crumbs from the plate.

A Kisman peddlar came up and tried to sell her a large shiny insect in a cage. She shook her head.

"The Kismen who are not good merchants work in peddling," she explained, after the peddlar had gone.

"You don't have charity programs, I understand?"

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Now there is no need for them," Swet-ein answered. She considered a minute, and said. "Let me explain all that. Last year I reached my quatan —sixteen of your years—and I received a credit account to spend as I wished. When I make a purchase I write it on a pink slip, to be filed, and it is deducted. What I earn is added. If I use it all I must repay it by working for the sick and wounded. The men must join the army. But now no one falls behind."

"Why is that?"

"Since the armistice the money the Worlds pay us is enough for all."

Which was disturbing. Kalin had known that the Worlds paid a tribute, but had understood that it was no more than a token. However, considering it now, modest amounts from ten thousand sources could add up to a great deal for one planet. "No one has to work then?" he asked.

"Not unless he wants to. Like the peddler."

Kalin was not learned enough in sociology to be certain, but his belief had always been that man is meant to work. His nature demands it. Without it his life lacks purpose, and his spirit shrivels. He had read also that too much leisure had been the downfall of civilizations. With the Veldqans it should be the same, he guessed.

Was that the cause of the troubles here, or at least a contributing factor? He would have to give that consideration, and perhaps investigation.

As they left the restaurant an old man dashed past, his eyes wide with terror. Close behind him came a burly younger man, obviously in pursuit. Instinctively Kalin started after the pair, ignoring Swet-ein's attempt to stop him. He was not in time. The younger man caught his quarry and circled his neck with both arms, and jerked. They could hear a muffled crack as the neck broke.

The fellow dropped the dead body as he saw Kalin approaching. "What do you want?" he snarled. Kalin closed with him, and he pulled his shoulders up and grabbed his warrior knife.

Kalin forced him back, clutching his wrist in the same motion, and giving it a huk huk twist. The knife dropped from his inert fingers.

He kicked viciously at Kalin's groin, shouting "Get away from me! I'll kill you!"

Kalin avoided the kick and bent the man's arm up behind his back, and he began to yell, "Sentinel! Sentinel!"

Kalin grew aware that Swet-ein was pulling at him, repeating, "That was his father, that was his father!"

A tall policeman in a metal-mesh waistcoat came running up. "What's the disturbance here?" he barked authoritatively.

Kalin released his prisoner. "This man—"

Swet-ein hurried in. "He is a stranger!" she told the sentinel urgently. "He does not know our customs."

The sentinel ignored her, and regarded the dead man in the street. "He was your father?" he asked the killer.

"Yes." The man was quiet now, calmed by the presence of the sentinel. He was the law here, the judge and the jury. Sentinels made the decisions, and often executed them on the spot. If a

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

citizen fought one, or even argued too vigorously, he risked his life.

"Did this person assault you?" the sentinel asked the Veldqan, indicating Kalin with a motion of his head.

"He did. Without provocation."

"Do you wish to charge him?"

Before the man could answer Swet-ein turned on him, fiercely. "He is a special envoy. He was brought here from Old Earth, at the request of Councilman Trobt." As the Veldqan wavered, she added, "If you demand satisfaction, the Council will make the same claim on you."

They waited a long minute for the man's decision. There was little fear in him, but the complexities of the situation had unnerved him. "I will consider myself atoned," he mumbled, and picked up his knife and stalked away.

Swet-ein said nothing more, but regarded the sentinel imploringly. He remained impassive, but spoke to Kalin, quite kindly. "You will know that on Veldq it is the duty of a son to kill his father when he grows too old, when his lessening faculties make him a burden on his family. But as there is no complaining party, you may walk free." He nodded and left them.

Swet-ein put a hand in Kalin's, subdued now, as they returned to their raft. "Before the money came from the Worlds' tribute there was no surplus of goods, and the very old ones could not be supported. There is more now, but the killing is sometimes still done." She squeezed his hand. "But you were brave and fierce," she complimented him. "A dleeth. I will love you more."

Normally Kalin did not approve of women who enjoyed watching men fight, but this one was the seed of a warrior race—and he loved her. He realized that for the first time now. "You were a tigress," he returned the compliment.

They crossed the lake again, and as they walked toward their car they passed a jewelry store. Swet-ein pulled at Kalin's sleeve and led him inside, where she picked up a metal ring from a counter and attached it to his belt. "Your reward for being so brave," she said, coquettishly.

"What is it?" he inquired.

"A child's ring. All warriors wear them."

Kalin remembered. Another relic of the days of the dleeth. When a child grew weary, as a family fled, it would hold onto the ring to aid it in keeping up. By now it had become a male ornament.

Before they started back they saw, at the far end of the settled territory, a half dozen operatorless machines working industriously to level a hill and to clear space for more buildings. Two other machines were smoothing out an embryo street. The City was growing fast.

That night before going to sleep Kalin reviewed what he had learned since coming to Veldq, giving it all his power of concentration. It was a method he had mastered years before: he'd present his subconscious with all the collected facts and observations, and direct it to find an answer. In the morning he would often have a solution.

When he awoke his first thought was that his subconscious had failed him.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

There was no answer, nothing but a name: Iten Iten.

Kalin dug into his memory banks. His father had had contacts with a Kisman merchant named Iten Iten. He awakened Swet-ein by preparing a breakfast of whey sprinkled with blue cheese. She rose quickly, amazing Kalin as always with the advance in her physical transformation. She was already a beautiful young woman, with a body lithe and feminine.

He was amazed also by the love she presented him, seeming to inhabit not his mind but his moods, sharing everything he felt, and approving of them, approving everything about him. Which was undeserved, but gratifying.

When she finished Kalin asked her if she could take him to a Kisman shopkeeper named Iten Iten. "I will look," she answered, and consulted a directory machine and said, "It is near."

They left the apartment and walked until they came to a shop displaying military boots in its front window, and went inside. A bearded shopkeeper with a patch over one eye greeted Kalin boisterously. "The Idiot's son, I will wager!" He wrapped both arms around Kalin and squeezed mightily. He saw Kalin's puzzlement, and explained, "Your father and I played a game. He pretended to have lost his memory, and asked questions about things everybody knows. I pretended that he was demented, and answered them all." He paused and regarded Kalin. "You are a reader? You know the Russian story, *The Idiot*?"

"Quite well." Iten Iten was obviously an educated man, despite his lowly occupation.

"We each made fun with the other, but always we knew that the other was not to be taken at small value. I called him the Idiot and he called me the Old Pirate, but there was much affection. You are greatly like him." He hugged Kalin again. "He never came to realize that I knew all the while that he was not a true Veldqan, that he was here to spy."

"You knew that and didn't report him?"

"I am a Kisman."

The same answer Yondtl had given. This needed more explanation.

"What does being a Kisman have to do with it?" he asked.

Iten Iten studied him, much as Trobt had done, and at the end pulled at an earlobe and said, "You are your father's son." It was meant as a compliment. "You want to know why we hate the clansmen? I will tell you." He leaned forward and touched a forefinger to Kalin's chest. "We are the educated ones, we write the books, educate our children, and those of the clansmen who wish to attend our schools. We work hard, we grow the food, manufacture the goods, everything they must have. And are they grateful?" The question was rhetorical. "They despise us. They consider us inferior because we are not warriors, because we won't fight." His voice revealed the quick currents of his discontent. "Do you blame us for hating them for their condescension?" His voice was throaty with emotion.

"No, but—" Kalin paused to consider. "There's another side to this. Theirs is a warrior ethic. They are raised in a warrior culture, honoring bravery, fortitude, skill in battle arts, and the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

family. Is that so despicable, and aren't your complaints more because of hurt pride than any actual injury?''

''No, no, it is more than that. Did you know that we are not allowed to enter the GAMES when they are taken to determine positions in government? We have no warrior status, they say. We are too lowly, they mean. We Kismen would beat them all; we would be the highest officials. They know that, and so they forbid us to play.''

They talked until Kalin had no more questions to ask. A racial controversary was involved here, he understood at the end, the kind that had been played out on many Worlds. That could lead to disastrous conflict.

The following morning they were interrupted at breakfast by a wallphone calling Swet-ein's name. She went to answer. Her end of the conversation consisted of ''Yes. Yes. I will.'' Yet Kalin realized that something portentous was happening here.

When she finished, and turned to him, her face was white, and her usually amiable features were clouded with ominous foreboding. ''Sit down, please,'' she requested.

Kalin obeyed, silently. For no reason he could name, he had a premonition that what he was about to hear would change both their lives. Intuition? Perhaps.

''Tomorrow is a special day for my clan,'' Swet-ein began hesitatingly. ''At that time they will make an accounting.'' She paused. ''The undesirables will be dispatched then.''

Kalin wasn't paying close attention. He had the perception that she was evading something more personal. ''And you want to go there?'' he prompted, hoping that would be the worst.

''I must. But not for the reason you think.'' She straightened in her chair, and went on resolutely. ''Tomorrow I will mate with Matt-ein, a clansman I knew when I was young.''

''Good god! You can't do that,'' Kalin protested angrily.

''It has been ordered by my clan, and I must.''

''Can they make you do it against your will?''

''It is against my will, but I must obey.'' She was grieved at Kalin's evident distress, and tried to soften the blow with an explanation. ''Listen to my telling you the reason now. All the clans must keep a balance in their numbers. Their home lands have limited room, and if too many babies are born they cannot be fed. They try then to give them to other clans who have a need for them, otherwise they are left in the woods to die. If the population grows too small they too will seek surplus babies. If that fails they will call back the females who have taken residence in the City. And we must return. So that is the reason.''

And that was the way it would be, Kalin feared. For beneath Swet-ein's gentleness, and her undoubted love for him, was a hard core of principle. Her resolution was probably inalterable, but he had to try. ''Is there no way I can hold you?'' he asked.

''Only if you fight Matt-ein.''

Kalin never hesitated. ''I will do that, certainly.''

''Of course.'' Swet-ein accepted it as a foregone conclusion. ''But you must

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

know that one of you will die," she cautioned. "A clansman fight ends only with the death of one of the opponents."

"When will we leave?" Kalin indirectly answered her.

The copter hovered over the river that bordered Orlt-ein territory on the south, as the pilot searched for a landing spot not too far from the town. He dared not land inside the boundary.

From this elevated position Kalin could make out distant mountains on three sides, with the river below them on the other. Primitive societies were always integrated in territories with natural boundaries. On one mountainside he could make out a stone edifice resembling a large castle, but which was more probably a fortress that guarded the settlement below.

A light snow was falling, blown by a lazy wind across the village, composed of perhaps a thousand stone homes with a large stone building in the center. The copter pilot dropped them off on the far side of a log bridge. He would wait there for the *business* inside to be completed.

They crossed the bridge, and walked a half league to the town. The climate was colder here than in the City, Kalin observed, feeling the chill on his arms and legs, and noting how his breath made a white steam in the air.

At the town edge they were met by two men in their early twenties, both blond and blue-eyed with stout athletic bodies. They were obviously friends. Swet-ein ran to one and they embraced. When Kalin reached them she introduced him as her brother, Copt-ein. The "ein" must be a clan designation, Kalin decided. She introduced him then to the second man, named Matt-ein, startling Kalin.

Matt-ein was the man he had to fight!

Matt-ein was the-boy-next-door type, clean-cut, courteous, and friendly. That he and Kalin had to fight to the death was one of Aldous Huxley's ape-chosen ends.

Matt-ein and Kalin gripped wrists on introduction, and the four of them conversed for a few minutes, with none mentioning the fight that would take place that very afternoon. Only when they were about to part did Matt-ein drop back and speak in a low voice to Swet-ein. "It was not my choice," he assured her.

"I know," she answered, and rested a hand on his arm for a moment.

Kalin was vaguely astonished that all this was happening so undramatically. He had the feeling that none of it was real, that they were playing out a charade.

Sometime later Kalin and Swet-ein joined a crowd gathered about a courtyard in the center of the town. Perhaps a thousand citizens were already there, and others were hurrying in. In the middle a dozen women stood beside a large rock, chatting idly.

Abruptly a bell sounded, bringing instant silence, and a minute later two women emerged from the stone house, dragging a third woman between them. She was crying, and waving her arms loosely, but offering no real resistance.

The two women bent her backward over the rock, and one of the waiting women, with bristling white hair that made her look like a witch, stepped for-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

ward. Kalin saw that in her right hand was a short-bladed hunter's knife.

The prostrate woman, who had suddenly begun giggling loudly, saw the knife and realized only then what was about to happen. She began screaming—as the knife plunged into her heart.

Kalin's semi-shock overcame his empathy, and he turned and saw Swet-ein questioning a girl at her side. She turned back to Kalin. "The woman had eaten a poisonous herb and gone mad." She added nothing to the statement.

Another woman was brought from the long house, carried on a crude stretcher —and was quickly dispatched. "She must have had an illness from which she would not recover," Swet-ein explained, "Or it was infectious."

The third victim was a young man, tall and handsome, who walked to the execution rock without coercion, his step firm and steady, and lay back and accepted his fate without protest.

"Why would they kill such a man?" Kalin asked sharply.

Swet-ein was quite undisturbed, but again consulted the girl next to her, and answered, "He was digging a channel from the river to the village. If he had been allowed to complete it it would have saved much carrying of water."

"And they killed him for—" Kalin caught himself, as he realized what the young man's offense had been. Innovators were taboo in primitive tribes. They upset the established order, and could bring disruption to the clan. That was the reason also, he understood then why he had seen no evidence of the Worlds's products here.

The slaughter went on throughout the remainder of the morning, with perhaps thirty people dying, as the women continued culling the sick, the weak, and the defective. The race must be kept strong. Kalin was able to remain stoic all the while only by an effort of dissociation, that he had practiced often before, but now his empathy with the victims threatened to overcome his will power.

He was not surprised that the women had been assigned the task of weeding out the undesirables. They very probably ran the clan. Not as a matriarchy, but as non-commissioned officers ran a military company, with the captain and lieutenants serving as controllers and organizers. In this particular instance the men had probably chosen the victims the women had executed.

In the early afternoon the citizens who lived in the village dispersed to their homes for their noon meals, and the others ate from food bags they had brought with them. Some who remained were villagers who hadn't wanted to lose their positions of vantage, and lunches were brought to them by their families. A type of yam seemed to be the standard food.

"Shall we walk about the village?" Swet-ein asked after awhile, correctly reading the tension that had been building up in Kalin. He accepted gratefully.

The settlement was pretty much as he had seen it from the air, except that the stone building in the center captured his attention. The walls were built with a series of four arches over the top of a round doorway, with four covering them, and so on until the wall reached the top. On Old Earth this type of construction was known as Persian Dome

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

walls. Their very utility had led to the same discovery on worlds so far apart.

A bell sounded and they returned to the amphitheater. Matt-ein stood at a far end of the circle, with Swet-ein's brother in the middle. He would see that his sister's suitors fought fair.

Swet-ein spoke hurriedly, giving Kalin last instructions. "Kill him as quickly as possible," she directed. "Do not let your human instincts handicap you. If you wound him show no mercy." The daughter of warriors, Kalin thought, with distracted amusement.

"He will give no mercy to you," Swet-ein went on. If you let him live when he is wounded he will be disgraced. The clans will decide that you considered him a weakling, not worthy of a warrior's death. He and all his relatives will be banished to the wilderness, to erase the weak strain."

Copt-ein called them to the middle then, and as Kalin walked he was sharply aware of everything about him, of a baby whimpering at the far edge of the otherwise silent crowd, of the scent of fried yams from someone sitting near. He noticed that a woman he passed had dirty fingernails. An absurd observation, but welcome. All his faculties were sharp and alert.

Copt-ein gave each a hunting knife, nodded to them, and stepped back. And the moment had arrived. The gladiators stood eyeball to eyeball, separated only by a few yards of space. They studied each other for a time, both wary and cautious. Kalin noted the easy stance of his adversary, his muscular body, and his lack of uncertainty. This was the way of his clan, and he was a clan warrior, tested and fit. He had no doubts about himself or his ability.

They moved closer, and each made a feint, by unspoken agreement without intent of inflicting damage, merely to study each other's movements. Kalin noted a kind of cold-blooded caution in the other that had to be respected. They circled slowly, bobbing and weaving but making no serious passes. In his alert observation Kalin thought he detected a slower foot speed than his own, and a habit Matt-ein had of swinging his knife in an overhand motion. Without real interest he wondered what the other read in him.

And then it was the action began. Matt-ein sprang at Kalin, bringing his knife around in the overhead motion Kalin had noted earlier. Kalin bent at the waist, and swept his knife at Matt-ein's middle.

And he had fallen into a trap!

The overhand motion had been a decoy, and Kalin's sweep had cut through empty air. He felt a sharp pain in his left shoulder, and the next instant his left arm dropped limp to his side. He had no power to move it. A major cord had been severed.

The time had come to be done with caution, Kalin knew instantly. He ignored the screaming agony in his shoulder and made several swift foot and body movements. He briefly found an exposed left side, and drove his knife up under the rib cage.

Matt-ein's body swayed slightly, and the small-wrinkles at the corners of his eyes deepened. No blood showed, except a pink bubble that formed on his lips, and he fell on his back.

Kalin turned away from the wounded

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

youth. There was no way he would kill a defenseless man. He heard an angry murmur, and saw several clansmen spring to their feet. Swet-ein, he observed, was screaming something he was unable to hear above the roar of the crowd.

From behind him Kalin heard, "Kill me, damn you, kill me!" A pause. "Please." The voice was barely audible. Kalin turned and saw that somehow Matt-ein had regained his feet, and that in his eyes was a terrible appeal.

Not allowing himself to think, Kalin raised his knife and drove it deep into the juncture of Matt-ein's neck and shoulder. The last he saw was a vast relief in Matt-ein's eyes as he fell.

Swet-ein came running up to him as he stood sobbing for his vanquished opponent. She tried to hug him but he slid through her arms to the ground.

Kalin's mind was no longer clear, and the delayed pain struck in full force. Nausea threatened to choke him, but he refused to yield to it, and a flood of perspiration burst from every pore in his body. Only with an effort of will was he able to lie still. That was necessary for he could feel a run of blood down his left side, and he suspected that any movement would make it worse. He let Swet-ein remove his blouse, which was partly blood-soaked, and when the "witch" came running from the stone house with bandages he was grateful.

She placed a mash of green leaves on the wound and bound it tightly. Which was all he could ask. At this stage stopping the blood flow was paramount. Swet-ein and her brother helped him onto a stretcher, and several clansmen vied with each other to carry it. Apparently he had made a good impression. The copter trip took another four hours, but he was resting comfortably, and there was little pain, or excessive bleeding. Thanks, he suspected, to the leaf mash.

Kalin was surprised to find himself being taken to Yondtl's residence when they reached the City. "He is our premier surgeon," Swet-ein explained. Was there nothing the man didn't excel at, Kalin wondered.

The pilot must have called ahead, for Yondtl appeared quickly, as brusque and irritable as before. He directed the copter pilot and Swet-ein to assist him in carrying Kalin to the operating table, and afterward wheeled over an instrument cart. "How much blood did our brave warrior lose?" he asked, sarcastically. "Probably a great deal," Swet-ein answered.

"Tsk, tsk. He'll have to do a lot of sleeping after this." He began feeding plasm into Kalin's veins, and afterward shot in a tranquilizer, working without hurry, but with no waste of motion.

The tranquilizer worked quickly, numbing Kalin's body, and bringing a feeling of peace. When Yondtl began operating he felt no pain, and little concern. Sometime during the operation Yondtl mumbled "Thank the gods for lasers," and those were the only words he spoke until he finished three hours later.

Yondtl sourly pronounced the operation a success and wheeled a large egg-shaped cone over to the bed. He raised the lid, and with Swet-ein's and the pilot's help transferred Kalin inside. He

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

was being put under "blue sleep." He wondered how many days it would be.

Five days later he awoke to find Swet-ein waiting for him. "Yondtl had to leave on a trip to one of the Worlds," she informed Kalin. "He said not to baby yourself, it was only a scratch." Was it possible that the savant had a sense of humor?

The remainder of the day Kalin spent in what he called "One of my moping periods." Something brewed inside, but was never able to achieve concrete form. However, he did arrive at one certainty: the problem—and perhaps the solution—lay with the Kismen. That answer had come not as *un coup de foudre*, but as a slow accumulation of evidence, that in its ripe time presented an answer. The Kismen did the work that enabled the society to function, and received no appreciation. They resented that and the condescension of the clansmen. Which could lead to an ugly confrontation.

But what to do about it?

The next morning Kalin asked Swet-ein to take him to Kisman Island. "I need to know more about them," he said. "What better place than their island?"

Swet-ein never argued with him. She gave her usual smile of approval and said, "I will pack a lunch." She saw Kalin's teasing expression. "It is many hours from here," she defended.

They rode a white ribbon of concrete, with a mechanized strip in the center that held the car in a magnetized grip as they sped along. To set the vehicle on automatic, or return it to manual, required merely the use of simple levers.

They had ridden only a dozen miles before the red sands merged with a richer soil, and they saw acres of farmland, planted with several species of grain. Farther on farmers tilled the land with plows pulled by woolly beasts resembling yaks. Tractors were only sparsely in evidence.

A few miles farther on they saw herds of the "yaks" grazing. The conclusion was that a pastoral society existed here, side by side with the clansmen and the city dwellers. Which was natural and he should have expected it. One thinks of a world, or a country, as having only one class of people, but each has several, plus individual differences. The only question here was the proportion.

So much to learn, and so much to be done.

They drove for miles, with Kalin deep in thought, until in the distance they spotted a ragged, snow-capped mountain. "I will show you something that will interest you," Swet-ein said, switching off onto another paved road that led to the mountain and down a long tunnel.

Underneath was an immense factory. Kalin alighted and investigated eagerly. What he saw was the final stage in the manufacture of road graders, that on completion were carried farther along the tunnel on wide belts. Nowhere was there any sign of supervision. He was not too surprised to read FLUOR INDUSTRIES on a boiler, and JACOBS ENGINEERING on a process machine. Both Old Earth companies.

"As far as we can ride in a day these

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

factories are in place, making spaceships and other kinds of machines," Swet-ein said. "Even before the armistice some Veldqans had been to your Ten Thousand Worlds," she continued, conspiratorially. "You did not know of us then, but we knew of you. Our spaceships brought back many machine plans and tools from you."

Kalin did not reveal that that secret had been revealed for many years now. Plans for almost all of Veldqan industries had been stolen, bought, or copied from the Worlds.

"Did you know that we also learned to travel in space from you?" Swet-ein asked. Kalin pretended surprise, and let her tell him how a Worlds's spaceship had been captured when it became disabled and made an emergency landing on Veldq. In time the Kismen learned how to repair and operate it, and for perhaps two dozen years made other ships, and with them the Veldqans developed a surreptitious trade with the Worlds, resulting in a thriving industry of their own—as was evident here. From rumors back home Kalin understood that the Veldqans's invincible weapon had been developed from one they had taken from the grounded spaceship.

Leaving the mountain underground they stopped in a field of what might have been daisies, Swet-ein spread out a multicolored cloth and they enjoyed a pleasant picnic.

Kalin had a difficult time keeping his gaze from the white flesh showing at the open neck of Swet-ein's blouse, but then the sight and sound and thought of her had become a continuous symphony the last few days.

After lunch they proceeded down a narrow road through a mountain gorge pockmarked with mining ditches. The red sides of the ditches indicated that iron ore had been taken out. Which was the origin of the red sand, Kalin understood.

On a hillside to their right were hundreds of gray, ratlike creatures with yellow bird legs feeding on a bulbous orange fruit that grew on bushes covering the range. They fled as the car approached.

The remainder of the trip to the ocean took another hour, and they boarded a hovercraft for the short ride to Kisman Island.

The day was pleasant on the island, blessed with a warm sun and tempered by a cool breeze. They rented a three-wheeler and followed a tan-bark road along the shoreline, observing acres of forest and grassy fields. Yaks grazed on many of the fields, and other yaks were being milked in long sheds, with roofs but no sides. Dairy country. It could very well be the source of the whey and blue cheese they'd had for breakfast. Other than the fish houses they found no evidence of factories. This, too, was a pastoral society.

Kalin wondered about that. The early Kismen settlers on the mainland must have received less than a cordial reception from the clans. Yet they had persisted, and made a place for themselves. They were an adaptable people.

In the late afternoon they stopped by a blue lagoon reflecting a bluer sky.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

They took off their clothes and stretched out on a sandy beach, quite crowded with outsiders as well as Kismen—and all naked. Kalin took pleasure in the envious glances he received when Swet-ein walked past, feminine gold in a long-legged body. He had watched with fascination how the fire had been building in her the last few days, how her shoulders had rounded with feminine flesh and her breasts pressed against her blouse. He was restrained only by the lack of invitation in her eyes. They spent several hours swimming and lying on the dazzling white sand, enjoying the sun.

Afterward they followed the road as far as a small town that bordered on the fishing establishment where they had landed, and saw a line of people entering a large gray-painted building. They parked their vehicle, went inside, and found themselves in a round auditorium.

On a stage in the center stood Yondtl, giving a lecture on Mayo, the Hospital World. It became quickly evident that he was well-versed in its workings, and medically erudite. He was also revealed as well-traveled—and not the uncouth recluse he'd pretended to be. A game he played? A la Tony Boucher?

At the end of the lecture the audience was invited to ask questions. After some time, when the questioning had grown desultory, and some of the audience were beginning to leave, Kalin rose. "If I might conjecture an imaginary world, with a dominant warrior class and a less numerous tradesman class. The warrior clansmen regard themselves as superior and look down on the tradesmen. Who resent the condescension." He paused as the audience turned as one and regarded him. "Can you conceive of such a world?"

"That imaginary world is quite similar to one named Veldq." Yondtl's tone was jocular. He had recognized Kalin and Swet-ein. "I would say that trouble there is quite conceivable."

"If the tradesmen control the functioning of the society, they would be in a position of some advantage, would they not?"

"That is correct."

"Will you postulate what would happen if that minority class used its advantageous position to disrupt its society?"

"The warrior class would rise against them."

"And what would be the result?"

"The warriors have the weapons and a history of conflict. There would be a great slaughter of the minority class."

"Thank you." Kalin sat down.

Kalin and Swet-ein returned their three-wheeler to its rental station and made their way to the hovercraft dock—and found Yondtl waiting for them. "Thank you for your help," he offered.

Kalin regarded him questionly. "I helped you?" he asked.

"Your method of bringing out the danger to the Kismen was quite effective."

"But it was a strong argument against what you Kismen are doing."

"It was. And I am against that also—because of the inevitable result: suicide for the Kismen."

"But I thought—"

Yondtl interrupted. "Have you ever read the Old Earth tale, *The Spy Who Came In Out of the Cold*?"

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Kalin nodded, as his mind leaped ahead. "And you are the mole!"

"I am."

"Would you take a stroll with us, please?" Kalin asked, using the ploy to gain time, to absorb what he'd heard, and to make his mental adjustments. He decided to play on Yondtl's pride. He might learn more that way. "Are you the leader of the Kismen?" he tried.

"Who else would—" Yondtl pulled up short. "You are clever," he conceded, with exaggerated sincerity. "Just how much do you know?"

"I know very little, but I suspect more. It is my belief that you Kismen are trying to disrupt this society, with the aim of taking over."

Yondtl did not equivocate. "I'll admit that the hard-core discontents have carried on a campaign of limited destruction, with that purpose in mind. However, I have been able to keep them from more drastic action—terrorism, killing of officials, and such."

"They tried to kill me," Kalin reminded him.

Yondtl brushed that aside with a wave of a hand. "You were never meant to be killed. They merely wanted to frighten you. To scare you away."

Kalin could accept that. "Who are those hard-core discontents you mentioned?" he asked.

"There is little point in my trying to deceive you," Yondtl yielded. "You're so close to the answers now that you'll soon know the rest." He considered. "The discontents are the Kismen who have visited the Worlds, have seen democracy, and acquired the belief that all men are created equal. They want that same equality here."

"And how do you feel about it?" Kalin tested.

"I very much agree. And it will come. The human incursions will assure that. My reservations concern how rapidly it is done. Under the present conditions the humans are no more than a blight. They must be restrained as long as possible."

"I'm not entirely convinced of that," Kalin demurred. He had ruminated on it a great deal lately. "The Worlds have much to give you," he argued. "And if the growth of their incursions is inevitable, the wise course might be to accept it, and proceed with a planned, orderly transition, rather than waiting for turmoil and perhaps bloodshed before acting."

An obvious impatience had been building up in Yondtl as Kalin spoke. "I do not agree!" he said stridently. "To paraphrase Oliver Cromwell, I ask you, in the bowels of Christ, to consider that you might be wrong." Even in anger he was literate. He left them abruptly.

Kalin and Swet-ein did not take the hovercraft to the mainland, as they had planned. Instead, they returned to the resort and stayed for six days, lounging on the beach and taking long walks over country roads and fields. While Kalin meditated.

On the seventh morning Swet-ein woke Kalin early, and quickly prepared his breakfast—with urgency in her every movement. "Eat well," she asserted. She finished her plate and put more food on Kalin's plate. "Eat," she commanded. "It is necessary."

Kalin caught the urgency, and did his

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

best to obey. Swet-ein had put on her suit before waking him, he noticed, and guessed why.

After breakfast they drove back to the ferry dock, and rode across to the mainland. Swet-ein followed the way they had come, until she changed to a road that led up the side of the mountain they had passed on their way in.

Before they reached their destination they could hear a subdued roar from up ahead. It was a waterfall, they discovered when they arrived, a hundred yards from a green ravine. The setting was colorful, with red rocks and steep cliffs, but its rustic beauty was marred by the presence of a concrete dam at the top of the falls. Worlds's influence again, Kalin thought, with some distaste.

They followed the ravine to the left, along the mountainside, until they came to what appeared to be a limestone hut, with piles of stone beside its door. "The bridal cave," Swet-ein murmured, exhibiting a new shyness.

They went in, with Kalin impulsively carrying Swet-ein across the threshold. "When we leave we will be one," she said.

Inside, Swet-ein pinned her golden hair into a knot high on her head, disrobed, and assisted Kalin, in complete command now. Kalin had his moment of timidity, as a butterfly flutters.

Swet-ein came to him then, with anticipation in her golden loins, and stopped in front of him, giving him time to absorb her into his thoughts.

He put a hand to her neck, tentatively, and it seemed to come alive in his hand, and her breasts expanded, until they rested against the flesh of his chest. He breathed in a warm feminine fragrance, and knew that the moment had arrived. He pulled her close, and they sank to their knees—and Kalin entered her.

The realities in which they moved seemed to pause, and vanish, and a new cosmos came into being. Turbulent, timeless, yet a century long, with themselves the only entities in the new reality. And they knew an ecstasy too great to be contained. Until in its time came an all-encompassing deliverance.

They stayed drunk on each other until, unnoticed, the day had gone and darkness arrived without warning. They rose and drank deeply from a spring that bubbled beside a flower bed. Kalin noticed then that he was hungry.

Swet-ein said, "There is no food."

Kalin waited. "This is our make-believe cave," she explained. "Until some time ago the man and woman would be barricaded inside, with water but no food, and they would have to stay until the bride ripened. Only then would the rocks be removed and the couple freed. If the bride did not become with child they would be forced to stay until one was dead. Always it would be the man, for the woman was fortified by her myst."

That seemed unnecessarily harsh, Kalin decided, but then the clansman culture was harsh, and this was another way to insure the survival of the fittest.

"That is not the command now," Swet-ein reassured him. "We will leave when the hunger for food overcomes all others."

In college Kalin had had an economics professor who explained the work theory with a strawberry analogy: The first quart you pick brings 100 percent satisfaction, and 0 percent pain. How-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

ever, the satisfaction decreases and the pain increases with each quart picked. When the two meet you quit picking.

On the third day Kalin quit picking his strawberries.

They returned to the City and Kalin went directly to Trobt's office. He received Kalin with high expectations. "And what did you find?" he questioned, without the normal preliminaries.

Kalin had decided earlier to be direct. "The Kismen are the cause of your troubles," he declared.

Trobt dwelt a moment on that. "I had suspicions of them," he remarked. "But now I ask you why."

"Because you clansmen have treated them shabbily throughout their history, and they resent it."

"In that you are mistaken," Trobt objected. "We have never persecuted the Kismen, in any way."

"They are second-class citizens. Despite the fact that they do most of the work, and keep the society running, they aren't even permitted to qualify for the leadership posts."

"That is because they are—" Trobt caught himself.

Kalin took advantage of the slip. "That's what I mean. Unless those mores are changed you will continue to have your troubles."

Trobt's forehead creased thoughtfully. "I cannot deny what you say—as you present it," he admitted. "What would you suggest?" he asked.

Which brought Kalin to the crux of his visit. "This world needs an entirely new government." He ignored Trobt's raised eyebrows and continued, "Your present government can no longer cope with its increased population. You have a higher birthrate, and an influx of humans—with their establishments, and different customs—that will soon overwhelm you."

Trobt did not protest, nor did he agree. "Yes?" he said.

"To govern effectively you must expand, compartmentalize, assign responsibilities, put in place people skilled in their particular duties."

Trobt turned in his chair to give Kalin direct attention. "I have no quarrel with that," he conceded. "I have observed it on many of the Worlds." He was a man of keen intellect, Kalin knew, and must have understood before this much of what he'd heard. "Tell me how it can be done?" he requested.

"I can't give you details, I don't believe any man could. But right now it's imperative that you set up a commission to study it. Bring in your best and your brightest, have them research and disseminate, until they come up with a system of government that is adequate to handle the increased population and its concomitant problems."

Trobt offered no objections, only asked mildly, "Where will we get all those experts?"

"You get them from the clans, from the City, from the Kismen."

"The Kismen?" Trobt's tone indicated his first opposition.

"Definitely. Many of the Kismen have the very skills you'll need: the ones they use in their own business enterprises."

"The clans would never agree to an equal status."

"Time will cure that." Kalin in-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

tended to say more, but saw that Trobt wanted to interject.

"My instinct is to agree," Trobt said. "In a cosmopolitan government such as you suggest there would be a good deal of personal contact, and interrelationships, between the classes. Prejudices would tend to vanish."

"And the Kismen would no longer have cause for complaint," Kalin agreed. "They'd have the equality they asked for." Kalin reflected that he should have expected the understanding and generous spirit from Trobt. He availed himself of the opportunity to observe, "This project will rise or fall on the wisdom of its moderator. He must be the best." He waited. Would the bait be taken?

Trobt regarded him speculatively. "Would you consider it?"

"I'm not the best man for the job."

Trobt studied a ceiling rafter. "Yondtl!" he announced, after a minute, and reached over and gripped Kalin's wrists.

A few minutes later, as he was ready to leave, Kalin looked about and found Swet-ein at another desk, putting down a telephone. "Yondtl will receive us as quickly as we can arrive," she said impishly.

Surprisingly, Yondtl accepted his proffered appointment with little reaction, with neither joy nor argument. Only when he suggested a GAME did Kalin suspect that he was concealing his emotions only with an effort.

The GAME was well along before Kalin tried his ploy. "Have you ever heard of the United States of America?" he asked.

Yondtl didn't miss a play. "A national entity in the ancient days of Old Earth," he recited. "Washington, Lincoln, Bush—"

"Bush?" Kalin questioned.

"Read my lips. Bush. One of the less recognized great presidents."

"Can you tell me anything about their constitution?"

Yondtl moved a pukt. "Written by James Madison, amended by Thomas Jefferson, emphasizing the inalienable rights of man, and setting up a triad system of government. A congress, supreme court, president . . ."

Kalin's attention wandered, until he heard Yondtl say, "Are you suggesting by your questions that our study group consider that constitution as a model?" And before Kalin could answer, "An excellent suggestion."

Yondtl reached for a pukt, his hand remained suspended, and an expression of startled agony sprang into his eyes.

"Checkmate," Kalin said. ■

Editor's Note: This is a sequel to "Second Game," which appeared as an Astounding *novelette in 1958 and later as a full-length novel published by DAW in 1981.*

MOVING? If you want your subscription to *Analog* to keep up with you, send both your old address and your new one (and the ZIP codes for both, please!) to our subscription department: Box 7061, Red Oak, Iowa 51566.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Marc Davenport

HYDROGEN TIME

A hydrogen-based energy economy has long seemed tempting, but hard to sell. It may be getting much easier now. . . .

From *The Mysterious Island*, 1875:

"And what will they [our great-grandchildren] burn instead of coal?"

"Water," replied Harding.

"Water!" cried Pencroft, "water as a fuel for steamers and engines! water to heat water?"

"Yes, but water decomposed into its primitive elements," replied Cyrus Harding, "and decomposed, doubtless, by electricity which will then become a powerful and manageable force, for all great discoveries, by some inexplicable law, appear to agree and become complete at the same time. Yes, my friends, I believe that water will one day be employed as fuel, that hydrogen and oxygen which constitute it, used singly or together, will furnish an inexhaustible source of heat and light, of an intensity of which coal is not capable. Some day the coalrooms of steamers and the tenders of locomotives will, instead of coal, be stored with these two condensed gases, which will burn in the furnaces with enormous caloric power. There is, therefore, nothing to fear. As long as the Earth is inhabited it will supply the wants of its inhabitants, and there will be no want of either light or heat as long as the production of vegetable, mineral, or animal kingdoms do not fail us. I believe that when the deposits of coal are exhausted we shall heat and warm ourselves with water. Water will be the coal of the future."

"I should like to see that," observed the sailor.

"You were born too soon, Pencroft. . . ."[1]

Jules Verne, the great science fiction pioneer, wrote that prophetic passage well over a century ago. Although the wording now seems quaint, the message closely parallels what a growing number of scientists and business leaders are saying today. Compare it to this statement, made recently by John Appleby of Texas A&M University:

In the future, hydrogen will replace

[1] Jules Verne, *The Mysterious Island* (1875), part II, chapter XI (New York: Dodd, Mead & Co., 1958)

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

fossil fuels just as electricity replaced oil for lighting purposes, as diesel replaced steam engines, and the jet replaced the piston-engined airplane. In each case, the replacement seemed more expensive at first than its predecessor; however, the key was life-cycle cost.[2]

Appleby, a professor of applied electrochemistry, is director and cofounder of the university's Center for Electrochemical Systems and Hydrogen Research, which, along with the Florida Solar Energy Center, the Clean Energy Research Institute at the University of Miami, and the Hawaii Natural Energy Institute at the University of Hawaii, is participating in a federally funded research project studying ways to produce and store hydrogen cheaply on a large scale and use it to generate power.

John Bockris, a professor of chemistry at Texas A&M, cofounded the facility with Appleby. If any one person can be credited with leading the 3,000 scientists around the world who are working to see hydrogen replace fossil fuels, it is Bockris. He first became fired with the idea in 1969, when General Motors, concerned that the world's oil supply might run out, asked him to look at alternatives to the gasoline-powered automobile. Today he foresees a "hydrogen economy," with hydrogen being piped from arrays of solar panels in the sun-drenched plains of Texas to the bustling cities of New Jersey, being used throughout the world to fuel everything from power plants to home furnaces, automobiles and aerospace planes, and returning our sick atmosphere to health.[3]

Unlike Verne, Bockris and Appleby and their colleagues may well see their dreams become reality. And it may happen even sooner than they imagine, because recent technological advancements and growing sentiment against the dangers of both fossil fuels and nuclear power are rapidly removing obstacles that have long blocked a "hydrogen revolution."

ELEGANT FUEL

Hydrogen is "squeaky" clean. It is the only combustible fuel that does not pollute the air when it combines with oxygen. Burning coal gives off an assortment of pollutants ranging from carbon monoxide and carbon dioxide to sulphur dioxide. Oil, gasoline, and diesel produce pollution when they burn. Even natural gas and alcohol, the so-called "clean fuels" produce prodigious amounts of carbon dioxide, which traps solar heat in the atmosphere. The combustion of hydrogen, on the other hand, creates only absolutely pure water vapor (and also infinitesimal amounts of oxides of nitrogen if it is burned in air instead of oxygen). The condensed exhaust from a hydrogen furnace or engine can be used directly for drinking water without any purification.

Nor does spilled hydrogen ruin the environment. A colorless, odorless gas, it is so buoyant in air that, when spilled, it races up toward the mesosphere, leaving no mess behind. Spilled fossil fuels,

[2]John Appleby, as quoted in Philip C. Cruver, "Hydrogen: Tomorrow's Limitless Power Source," *The Futurist*, Nov./Dec. 1989, p. 24.

[3]Robert Keating, "Road to Power," *Omni*, Jun 1989, pp. 66-74.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

on the other hand, cost billions of dollars in property damage and cleanup fees. Spilled gasoline and leaking underground tanks create fire hazards and spoil drinking water. Oil spills cover beaches, destroy wildlife, and wreck local economies. And they are becoming common. As this article is being prepared, sixteen major oil spills have occurred in the last two weeks, and a tanker containing 38 million gallons of crude oil is aflame and in danger of sinking off the Texas coast.

Pound for pound, hydrogen is the most energetic of all combustible fuels. It is about 2½ times as powerful as gasoline—so powerful that its invisible flame drives those thundering main thrusters that hurl our space shuttles into orbit.

Hydrogen burns far more efficiently than any conventional fuel, igniting evenly in such a wide range of concentrations that it can be burned alone or in combination with any ratio of gasoline, natural gas, coal, wood, and a host of other combustibles in nearly any engine, boiler, or furnace after minor equipment alterations. It has already been successfully used in scores of applications. In the 1930s, German engineers, short of gasoline, used it to fuel all types of vehicles, from zeppelins to submarines. An American inventor named Roger Billings converted cars, cookstoves, ovens, furnaces, and even barbecues to burn hydrogen in the 1970s. Daimler Benz introduced a sedan that burned an infinitely variable mixture of gasoline and hydrogen in 1977, and today has a fleet of hydrogen-powered buses on the road.[4] Both the US and the Soviets have used it as aircraft fuel during tests.[5]

Hydrogen is the only combustible fuel that is both 100% renewable and available in virtually limitless amounts, in sharp contrast to fossil fuels, all of which are completely non-renewable and will be depleted much too soon for comfort. According to Robert L. San Martin, a Deputy Assistant Secretary for Renewable Energy of the US Department of Energy, the US energy reserve will last only about 75 years if our rate of consumption doesn't increase.[6] But it *is* increasing. A few other countries have larger reserves, but those too will dwindle quickly because developing countries that are now industrializing will soon surpass the industrial nations in energy consumption.

Unlike nuclear fusion, which we will someday learn to harness, hydrogen power is available right now, today. Although we are learning more about it all the time, we already know everything we need to know to begin using it on a global scale.

ELECTROLYSIS IS THE KEY

Hydrogen is the most abundant element on the surface of our planet, comprising two-thirds of every molecule of water. It can easily be separated from

[4]Peter Hoffmann, *The Forever Fuel* (Boulder, Colorado: Westview Press, Inc., 1981).

[5]Peter Hoffmann, "A Soviet Flight Could Give Hydrogen a Lift," *Business Week*, 28 Nov. 1988, p. 131.

[6]Robert L. San Martin, "Renewable Energy: Power for Tomorrow," *The Futurist*, May/Jun. 1989, p. 38.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the oxygen that makes up the other third of the water molecule by a simple process called electrolysis, in which an electric current is passed through electrodes immersed in water that contains an electrolyte. The electrolysis of water is a well-developed technology, having been used on an industrial scale since 1927, when a Norwegian utility built an electrolyzer to produce 142 tons of hydrogen daily.

Electrolysis is what makes a hydrogen economy possible and desirable. At present, only about two dozen or so countries produce significant amounts of petroleum. But because of electrolysis, any country that has electricity of any kind and water of any kind—including sea water—can make hydrogen. As a result, scores of countries will have at their disposal the means to make all their own fuel as soon as they change to hydrogen.

Most important—for this is the key to a hydrogen economy—electrolysis makes possible the use of hydrogen as a universal medium of exchange because it allows for the storage of electricity from any primary source, *including* clean renewable sources like solar, wind, hydroelectric, geothermal, ocean-thermal, and tide energies that are free to anyone who wants them—sources that have historically been of little use, but which have enormous potential.

How much is enormous? The US Office of Renewable Energy has determined that renewable resources accessible to the US right now, using the extraction methods currently available, could provide enough energy to last 5,600 years.[7] A US Department of Energy sponsored study estimates that there are 50,000 sites in this country where falling water could be harnessed to make electrolytic hydrogen.[8] Ken Zweibel, a project coordinator for photovoltaic research at the Solar Energy Research Institute in Golden, Colorado, has suggested that a square of photovoltaic cells 67 miles wide near Denver could produce the same amount of electricity now consumed in the entire United States.[9] (Photovoltaic, or "PV" cells convert sunlight directly into electricity). Joan M. Ogden and Robert H. Williams, scientists at the Center for Energy and Environmental Studies at Princeton University, claim that a circle of the cells 240 miles across placed in New Mexico or Arizona and equipped with electrolyzers could supply hydrogen equal to all the coal, oil, and natural gas burned in the US in 1986.[10] (Of course, as Zweibel points out, there is no need to put all the cells in one place; they could be placed on rooftops and along highways instead).

As University of Oklahoma at Norman professor L. W. Zelby demonstrated back in 1974, making and storing electrolytic hydrogen can be extremely simple. Zelby calculated that by using electrolytic hydrogen as a storage medium, a self-contained wind power system capable of producing all the

[7]San Martin, p. 38.

[8]Hoffmann, *Forever Fuel*, p. 103.

[9]James R. Chiles, "Tomorrow's Energy Today," *Audubon*, Jan. 1990, p. 66.

[10]Philip C. Cruver, "Hydrogen: Tomorrow's Limitless Power Source," *The Futurist*, Nov./Dec. 1989, p. 25.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

electricity to power an Oklahoma home could be built for only about $5,000. His design called for a 46-foot windmill to turn a generator wired to an electrolyzer. Whenever wind blew, the electrolyzer was to produce hydrogen, which would be compressed and stored in a tank. A nine-horsepower lawn mower engine, easily converted to burn hydrogen, was to draw fuel from the tank and turn a generator to produce electricity as needed.[11]

Zelby's idea was simple and efficient, and required no new technology. It eliminated much of the waste inherent in centralized generation methods by producing and using power at the same site (only about 25% of the energy generated by burning coal reaches consumers' appliances). But the true beauty of it was that the hydrogen storage tank would be able to store energy every time the wind blew, even if there was no demand for energy at the time.

One of the principal objections to renewable energy sources like solar, wind, and hydroelectric has always been that the capricious nature of weather makes them impossible to use in the same way burning coal is used unless expensive methods are employed to level out supply to match demand. Wind and sunshine, though free, are available in immense quantities one moment and gone the next. Spring floods, with a potential to produce tremendous amounts of hydroelectric power, often coincide with the lowest demands for electricity, while the highest demands occur during summer droughts or frozen winters, when water flow is at low ebb.

Conventional leveling methods are inefficient. PV cells and windmills charge storage batteries, but these can be short-lived, expensive, and slow to recharge. Hydroelectric plants store water in impoundments, then release it as power is needed, but floods often far exceed the demand for electricity and pour over dams unused. But leveling methods using approaches similar to Zelby's electrolysis/storage/reconversion process promise to make renewables reliable enough to compete directly with fossil fuels and nuclear power.

The same methods may make possible the harvesting of energy where no attempt has been made before. Since energy can be stored for later collection instead of having to meet large user demands as they occur, small systems can be used as effectively as huge centralized ones. Multiple small water wheels, not needing impoundments, could be employed to turn small generators fitted with electrolyzers along rivers that could not or should not be dammed because of environmental or cost considerations, or because impoundments would flood farmland. They could also be installed at flood-control dams that are not currently being used to generate electricity. Windmills could be used in areas where wind blows less than in the California mountain passes, where 90% of the aerogenerators in the US now stand. Rafts of PV cells could be floated on the open ocean and their hydrogen collected at intervals for ship fuel. The tremendous forces of rising and falling

[11]Hoffmann, *Forever Fuel*, p. 100.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

tides along coastlines could be harnessed once or twice a day, and the resultant hydrogen distributed evenly throughout the course of the following day.

Several utilities have already proven that electrolysis and reconversion can work on a large scale. PSE&G, of Newark, New Jersey, had good results using a Teledyne electrolyzer to convert off-peak power to hydrogen, then reconverting it to electricity using a Pratt & Whitney fuel cell (fuel cells employ a catalytic reaction that amounts to the reverse of electrolysis, and have been a source of electricity and drinking water in spacecraft for years). Canada's Hydro Quebec deemed the idea so profitable that it seriously considered spending millions of dollars to export electrolytic hydrogen to Europe until it instead contracted to sell all its available power directly.

OBSTACLES

Despite its astonishing virtues, hydrogen has not been able to supplant oil and coal. The reason: simple economics. Coal-fired generating facilities typically charge customers about $0.06 per kilowatt-hour for electricity. Solar-thermal operations must charge twice that amount, and power from PV arrays is yet more expensive. As this article is being prepared for publication, the situation in the Middle East has caused the pump prices of gasoline to rise to an all-time high of about $1.40 per gallon. But, according to a 1988 estimate by Ogden and Williams, even if very efficient PV cells were used in desert areas, the equivalent pump price of electrolytic hydrogen would be from $1.55 to $2.[12]

Hydroelectric plants can deliver hydrogen for about the same price as gasoline, but the generating capacity of such plants that are in a position to do so is so small in relation to the total amount of energy we use that not enough of a market share could be captured to make investments in hydrogen cars and gas stations profitable. Even auto manufacturers willing to take risks to put hydrogen-powered vehicles on the market must tackle another problem—the same problem that has kept aircraft manufacturers away from hydrogen.

It's a problem of space. Hydrogen is so light that a quantity of it sufficient to power an automobile for more than a few miles takes up a lot of area. Even compressed into a liquid, it has a larger volume than an equivalent amount of gasoline. The tanks needed to store it must be so bulky and heavy that cars and airplanes using it as fuel must either refuel more frequently or be larger than gasoline-powered ones. And liquid hydrogen is so cold that storing and handling it can be dangerous and costly.

No manufacturer wants to offer consumers vehicles that are more expensive to operate and less convenient. And no government will allow the world's economy to be turned upside-down (which is essentially what a complete change to hydrogen would amount to) unless

[12]Peter Hoffmann et al., "The Fuel of the Future is Making a Comeback," *Business Week*, 28 Nov. 1988, p. 130.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

there is profit to be made. Businessmen and politicians can be expected to protect the status quo and their oil profits until they can make more profit with hydrogen.

James R. Birk, director of storage and renewable energy at the Electric Power Research Institute in Palo Alto, California (the research arm of the US's electricity generating industry), is among those who think hydrogen's time has not yet come. Although he admits that " 'sometime in the 21st century, hydrogen will be a major part of our energy infrastructure,' " he is skeptical about PV power being competitive with today's cheap oil and gas.[13,14] Mark Mills, president of Science Concepts, Inc. (an energy consulting firm in Washington DC), and Carl Goldstein, a vice-president of the US Council for Energy Awareness, agree that the cost of production will keep the hydrogen economy from happening unless hydrogen drops in price.[15] Even John Appleby doesn't expect the revolution to happen until after the turn of the century.[16] But new developments may soon cause Birk and the others to change their minds.

BALANCING THE ECONOMIC EQUATION: THE HIDDEN COSTS OF FOSSIL FUELS

The current cheap prices of fossil fuels will eventually increase. Even if the OPEC cartel does not repeat the actions that raised the per-barrel price of oil from $3.10 in 1973 to $36 in 1982, supply and demand will force prices of all fossil fuels higher than hydrogen because of depletion. But long before that happens, fossil fuel prices will probably rise dramatically because cost factors that are not now included in these prices will have to be internalized.

Chief among these factors is the cost of pollution.

Because of the huge volume of fossil fuels we burn, clean air is so scarce today that samples used to establish clean air standards are difficult to obtain. Five million tons of pollutants are spewed into Mexico City's air annually. Los Angeles is so smog-choked that legislation is being designed that will require 40% of automobiles, 70% of trucks, and all buses to convert to clean fuels by 1998 (gasoline engines will probably be banned altogether in Los Angeles by 2007).[17]

Studies indicate that acid aerosols and acid rain caused by smokestack and automobile emissions cause tremendous damage. In some European and US forests, half the red spruce trees have died since 1964. Fish are all or mostly dead in a quarter of Adirondacks lakes, 14,000 Canadian lakes, and much of southern Norway.[18]

The dollar loss of forests, fisheries, and crops due to pollutants from fossil

[13]James R. Birk, as quoted in Hoffmann, "Comeback," p. 130.

[14]Chiles, p. 65.

[15]Keating, p. 72.

[16]Associated Press, "Hydrogen is Fuel of the Future Say Scientists," *Joplin* [Missouri] *Globe*, 3 Sept. 1989.

[17]Robert Reinhold, "Los Angeles Weighs Change to Cut Smog," *New York Times*, Late City Ed., 19 Dec. 1988, Sec. 1, p. 14, col. 4.

[18]Betsy Carpenter, "What Goes Up Must Come Down," *U.S. News and World Report*, 25 Jul. 1988, p. 44.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

fuels is immense. In the US alone, $8.2 billion is lost each year just in farm produce. The human cost cannot be expressed in dollars, but Nejat Veziroglu, director of the Clean Energy Research Institute at the University of Miami and president of the International Association for Hydrogen Energy, estimates that just the deaths from respiratory disease and illness caused by fossil fuels cost the US $133.8 billion annually.[19]

If the theories of a growing number of climatologists are correct, the losses we are now suffering because of fossil fuels are slight compared to those that may soon follow.

Since the 19th century, we have burned wood, coal, gas, and oil at a fantastic rate. This has caused the concentration of carbon dioxide gas in our atmosphere to rise by 24%, and the rate of increase is accelerating by .4% yearly. The air now contains more carbon dioxide than at any time in history. Nearly 3 billion tons more carbon will stay in the atmosphere this year than last.

Carbon dioxide traps solar heat. The more the atmosphere contains, the more heat is trapped. So our climate is becoming warmer. Many climatologists agree that if pollution ceased immediately, this "greenhouse effect" might raise average global temperatures by .9 to 2.7 degrees (Fahrenheit) before the atmosphere stabilized years later.

Of course we are not all going to give up our cars and electricity this evening, so greenhouse warming will worsen. And the results could be catastrophic. Stephen Schneider, of the National Center for Atmospheric Research in Boulder, Colorado, says the climate could change 100 times as fast as at any other time in our history.[20] Many studies predict a 3 to 9 degree rise in temperature within a few decades if we don't change our habits drastically. This could raise ocean levels by as much as 7 feet, inundating huge areas of populated land and farmland. The Environmental Protection Agency has said it could cost $111 billion just to protect developed coastal areas in the US from oceans.[21] Greenhouse warming could also greatly increase the frequency and severity of storms and droughts, causing terrible losses of life and property. In all, millions could be left homeless, starving, and sick, and the world's economy could be bankrupted.

Most studies consider only the next 100 years, and estimate a temperature rise of 12 degrees or less, but greenhouse warming is cumulative. Given a longer period of time, the greenhouse effect might intensify to such a degree that the Earth would become uninhabitable.

In June of 1988, Dr. James E. Hansen, head of NASA's Goddard Institute for Space Studies, told a US Senate subcommittee that he was nearly certain greenhouse warming had already begun.[22] His conclusion was understand-

[19]Keating, p. 72.

[20]Michael D. Lemonick, "Feeling the Heat," *Time*, 2 Jan. 1989, p. 37.

[21]Philip Elmer-Dewitt, "Preparing for the Worst," *Time*, 2 Jan. 1989, p. 70.

[22]Philip Shabecoff, "Global Warming Has Begun, Expert Tells Senate," *New York Times*, Late City Ed., 24 Jun. 1988, Sec. A, p. 1, col. 1.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

able, considering: The five hottest years of this century (measuring average global temperature) occurred in the last decade; 1987 was the hottest year since accurate record keeping began 129 years ago, and the first five months of 1988 were hotter still; 6% of our polar ice has melted since 1974; Louisiana is losing an acre of ground to the rising ocean every 16 minutes.

During that same month, a large group of scientists and officials, alarmed by the effects of pollution, held a World Conference on the Changing Atmosphere in Toronto. Their conclusion, released in a conference statement, was chilling in the extreme: "Humanity is conducting uncontrolled, globally pervasive experiments whose ultimate consequences could be second only to a global nuclear war. . . ."

The delegates recommended carbon dioxide levels be decreased by 20% by 2005 and 50% by 2050, but many agree that such action would be too little too late. Jim MacKenzie, senior associate at the World Resources Institute in Washington, DC, thinks the amount should be 50% to 80%.[23] Three avenues, all of which will be enormously expensive, must be followed to accomplish either goal: reforestation, conservation, and the development of alternate fuels.

Plants absorb carbon dioxide, storing the carbon. Consequently, forests can counteract greenhouse warming by taking carbon dioxide out of the air. But instead of planting more trees, we are making the problem worse by cutting trees down for logging and farming at a rate of about 51 acres per minute. The National Academy of Science estimates an area of rain forests the size of England, Scotland, and Wales combined is lost every year. The Environmental Defense Fund says all the world's rain forests will be gone by 2032.[24]

Roger Sedjo, director of the Forest Economics and Policy Program at Resources for the Future, has suggested that it should be possible to reforest enough land to temporarily stabilize the atmosphere (which would only be a stopgap measure to buy time to develop alternate fuels). But the undertaking would not be cheap—Sedjo estimates $250 billion to $500 billion.[25]

Conservation may be even costlier. John Gray, chairman of ERC Environmental Services, was quoted in a recent article in *Nation's Business* as saying: *. . . to cut down on the use of energy to the extent that would preclude having to increase the supply of energy, you would have to rebuild the entire housing, transportation, and commercial infrastructure of the country. That's a $2 trillion bill right there.*[26]

And of course the measures Gray was talking about would only slow greenhouse warming; they would not reverse it.

[23]Keating, p. 70.

[24]Christopher Cokinos, "We're Destroying Our Rainforests," *Manhattan* [Kansas] *Mercury*, 22 Oct. 1989, Sec. C, p. 7.

[25]Roger A. Sedjo, "Forests: A Tool to Moderate Global Warming?" *Environment*, Jan. 1, 1989, pp. 14-20.

[26]John Gray, as quoted in Donald C. Bacon, "A New Energy Crisis?" *Nation's Business*, Feb. 1990, p. 25.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

The development of alternate fuels could be an equally high-priced project, and may ultimately prove futile. The fuels most likely to be developed—alcohol, for instance—are cleaner than gasoline, but still make large quantities of carbon dioxide when burned.

The money lost or spent because of pollution and the money paid to reforest, conserve energy, and develop alternate energy sources can all be considered "downstream" or "external" costs. These are costs that are not now included in the prices consumers pay when buying fuel or electricity, but which they must ultimately pay, as part of taxes, medical bills, increased insurance premiums, etc. There are many other such costs. For instance, every year in the U.S. alone, $73 billion worth of property damage is caused by leaking underground gasoline tanks and $4.4 billion is spent on reclaiming strip-mined land. An enormous amount of money is spent cleaning up oil spills and refurbishing buildings damaged by acid rain. And let us not forget military costs. According to Milton Copulos, president of the National Defense Council Foundation, $14.6 billion was spent for military protection of Persian Gulf oil back in 1987, long before Operation Desert Shield began.[27] The 1990 bill will, of course, be much higher.

A growing number of scientists and officials throughout the world are demanding that the industries that create these problems be held responsible for them. As Francis X. Stankard, executive vice-president of the Chase Manhattan Corporation, puts it:

. . . we have to face up to profound revolution. In the near future, we must build into the consumer's cost everything from the production value of a good, to the cost of disposal, and even its medical or environmental costs down the road.[28]

Veziroglu, Bockris, and 64 other scientists have petitioned for surcharges on products that hurt the environment. Mark Trexler, a research associate at the World Resources Institute in Washington, DC, suggests that conservation could be hastened by raising gasoline taxes by $1 per gallon.[29]

Government leaders around the world have begun to admit downstream costs must be internalized. Some have designed legislation to implement that process. Once such legislation becomes law, hydrogen produced from clean renewable resources—which creates no such costs—will be cheaper than gasoline. As Philip C. Cruver, president of Titan Energy, Ltd. puts it:

Gaseous hydrogen, taking its efficiency advantage into account, would cost about $1.40 for the equivalent of one gallon of gasoline. If we hold fossil fuels responsible for the environmental damage they do, then we have to add at least $1 per gallon to the true cost of gasoline. Therefore, even today, hydrogen

[27]Cruver, p. 25.

[28]Francis X. Stankard, "The Issue of Our Environment: Generations Pass—The Earth Abides Forever," Caux Industrial Conference, Caux Switzerland, 19 Aug. 1989. (For a copy of Stankard's speech, see *Vital Speeches of the Day*, 15 Nov. 1989, p. 85).

[29]Chiles, p. 61.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

is cheaper than fossil fuels when the overall societal costs are considered.[30]

NUCLEAR PROBLEMS

Even ignoring the fact that the preliminary processing of nuclear fuel releases large volumes of carbon dioxide, the cost of nuclear fission may be higher yet than that of fossil fuels. A typical 1,000-megawatt nuclear power plant may contain 40,000 valves and a bewildering maze of pipes, wires, and servomechanisms. The "triple back-up" systems necessary to prevent breakdowns are so expensive to construct (the Seabrook reactor in New Hampshire, for example, cost $4.5 billion to build) that consumers sometimes pay up to $0.20 or more per kilowatt-hour for the power they produce. This is nearly the cost of electricity from some large-scale PV arrays, and much higher than the $0.12 some solar-thermal plants charge.

But accidents occur anyway—not often, but when they do the costs are astronomical. Nearly $1 billion was spent to shut down and decontaminate the Three Mile Island reactor after its 1979 accident. The Chernobyl disaster of 1986 caused the evacuation of 135,000 Soviets from 179 settlements. Some 18,000 were hospitalized, 31 died soon afterward of burns, and 50,000 may eventually die from radiation-caused cancers after costing billions in health care. The cleanup has already cost the Soviets perhaps $6 billion. Other countries lost $500 million worth of crops and an incalculable amount of wildlife was ruined.[31]

The next accident might be worse. According to an Atomic Energy Commission study done before Chernobyl, a meltdown in the US might kill 27,000, injure 73,000, and cause $17 billion in property damage.[32] Meltdowns are less likely in US reactors, but not impossible; and many high-risk types (like the one at Chernobyl) still exist in eastern Europe.

Proponents of fission have now begun to push so-called "inherently safe" reactors. But even if these could be built at reasonable expense, which is doubtful, a large problem remains: Waste from nuclear fission cannot be made harmless, and cannot be disposed of safely.

Spent reactor fuel can remain radioactive for 50,000 years. The National Academy of Sciences has estimated that by 2001 we may have 72,000 tons of it. According to the Environmental Protection Agency, we may also have a billion cubic feet of low-level mining and milling waste—enough to cover a four-lane coast-to-coast highway a foot deep.[33] No one knows how low an exposure to low-level radiation can be injurious, but former EPA advisor Jay Gould and University of Pittsburgh radiologist Ernest Sternglass have suggested fallout from Chernobyl may have hastened the deaths of 35,000 Ameri-

[30]Cruver, p. 24.

[31]Dr. Robert Peter Gale and Thomas Hauser, *Final Warning* (New York: Warner Books Inc.—Warner Communications, 1988), pp. 133, 160, 176.

[32]Gale, p. 18.

[33]Gale, p. 190.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

cans.[34]

Understandably, the voters of many areas do not want atomic refuse crossing their borders, let alone being stored within them for 50,000 years. In the US voters are forcing old disposal sites to close and refusing new ones. Disposal is becoming increasingly pricey, and may eventually be impossible, which will force reactors to cease operations.

The nuclear fission industry in the US is dying anyway. No new reactors have been ordered and put into construction since 1973. Since the Three Mile Island incident, billions of dollars have been wasted as plans for 65 US nuclear plants were canceled and others that were nearly finished or in operation, like the Rancho Seco plant near Sacramento, California, were abandoned.

Still more reactors must soon be taken out of service due to obsolescence. But 70% of our fossil-fuel-fired plants are about 30 years old, and will be unable to provide power for all their customers. New coal-fired facilities would take years to finance and construct (and would continue to add to global warming and other forms of pollution), and fusion-powered plants are at the very least several decades away. Meanwhile, demand for electricity is rising, and will soon overtake supply. Brownouts and blackouts have already been occurring in New England and Florida during heat waves and cold snaps. Utilities that once discouraged small independent producers are now looking to independents to supply power during peak demands, and are paying premium prices for it.

THE HIDDEN ADVANTAGES OF HYDROGEN

While the internalization of external costs would greatly increase the price of carbon fuels and nuclear power, the internalization of revenues from by-products of electrolytic hydrogen production would greatly reduce the price of hydrogen.

One such by-product is oxygen. Electrolysis produces two parts hydrogen and one part oxygen. However, pure oxygen need not be used to burn hydrogen. The hydrogen can be burned with air and the oxygen sold to generate income. It is already used in a variety of industries, from health care to space exploration. It could also be employed in afterburners to make existing coal-fired plants and vehicles more efficient.

Another by-product is water. Cities like Los Angeles, which have an unlimited supply of salt water and must import increasing amounts of fresh water from far away at great expense, would pay for the pure water by-product of a hydrogen-fired power plant. Even cities that have plenty of fresh water available might buy it because its purity would obviate the need for purification plants—plants that are becoming increasingly costly as more and more of our ground water becomes contaminated.

The tremendous heat generated by burning hydrogen makes the hydrogen furnace an excellent means of disposal for hazardous wastes like PCBs and hospital refuse. Hydrogen-fired power plants

[34]Seth Shulman, "Chernobyl Fallout," *Technology Review*, Feb./Mar. 1989, p. 12.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

could generate additional income by charging fees for disposal of a wide variety of wastes.

Hydrogen itself, if produced in excess (during floods or periods of high winds) could be sold as an ingredient for fertilizer, foods, solvents, plastics, animal feeds, etc. It is also used in welding, glass cutting, space exploration, and a number of other applications. About 22 million tons of hydrogen are used each year, much of it in the manufacture of ammonia. In Ruhr, West Germany, a hydrogen pipeline has been used for half a century. It now consists of 130 miles of pipe, crosses the Rhine twice, and shuttles 10.6 billion cubic feet from four manufacturers to nine users.[35]

Excess hydrogen could of course also be sold for fuel, not only to users of newly-developed hydrogen-using vehicles and equipment, but also to distributors of other fuels. A Stanford Research Institute study determined that water from the Gulf of Mexico could be electrolyzed and introduced into the main natural gas pipeline trunk that fans out from the Gulf Coast to serve most of the US. A Department of Energy sponsored study found that this could stretch gas supplies by 20% without changing distribution, metering, or combustion equipment.[36] Over long distances, a volume of hydrogen equivalent to a kilowatt-hour can be transported via pipeline for about ⅛ the cost of sending a kilowatt-hour of electricity through transmission lines.

Because these products and services could be sold, hydrogen plants could operate at maximum efficiency all the time rather than varying output drastically from one hour to the next to accommodate changes in electricity demand. Because they would generate income, capital debts could be retired more quickly. As a result of these two factors, the prices consumers would pay for both hydrogen and electricity from these plants would actually be much less than has been suggested. And even if competition, mass production, and improved designs never decreased those prices, which is highly unlikely, they would always grow more slowly than the prices of existing energy because they would be based on free commodities like wind and sunshine instead of steadily depleted ones like coal.

NEW TECHNOLOGY

Even if we choose to ignore all external factors, hydrogen from renewable power sources remains indisputably on an imminent collision course with fossil fuels and nuclear power because of recent and continuing advances in technology.

The wind turbines now being manufactured are far more efficient than earlier models. Some 16,000 now operate in California, making possible an output of about 1,500 megawatts. A Pacific Gas and Electric sponsored study estimates the cost of the power they generate at $0.054 per kilowatt-hour.[37]

Solar-thermal plants built by Luz International, of Los Angeles, now crank out 194 megawatts of electricity for

[35]Hoffmann, *Forever Fuel*, p. 182.
[36]Hoffmann, *Forever Fuel*, pp. 103, 184.
[37]Chiles, p. 63.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Southern California Edison at a cost of about $0.12 per kilowatt-hour, half the 1984 figure. Within a few months, Luz expects to build larger plants that will cut that amount down to $0.08, and, according to Paul Savoldelli, the company's assistant general counsel, a similar plant using half natural gas and financed municipally could be competitive with any coal-fired facility.[38]

A German company, Bomin Solar, is building small solar-thermal power plants that heat hydrides and shuttle hydrogen back and forth between heat exchangers. According to the company's vice president and technical director, Hans Jurgen Kleinwachter, the devices can provide all the heat, electricity, air conditioning, and refrigeration a family needs each day and night.[39]

PV modules cost fifty times less than in 1973, and are becoming ever cheaper. They are getting more powerful, too. A few years ago they were only about 6% efficient, but records are now broken regularly. Boeing recently announced a 37%-efficient "concentrator" module. PV modules are being used in scores of applications, from billboard lights to battery chargers to power plants. Japan's Sanyo Electric has even developed PV roofing shingles.

The US Department of Energy reports that PV systems should be competitive with coal-fired ones for all applications by the year 2000.[40] But Zoltan J. Kiss, chairman of Chronar Corporation of Lawrenceville, New Jersey, which manufactures amorphous silicon PV modules, thinks parity will be achieved within four years.[41]

The problem of needing large tanks to store hydrogen is being solved by the development of compounds that can absorb pressurized hydrogen into their structures the way a sponge absorbs water and releases it when heated. Daimler Benz and other firms have used tanks full of titanium-iron hydride with good results. Now professor Seijirau Suda, of Kogakuin University in Tokyo, is working with a magnesium compound that can "soak up" six times as much hydrogen as other compounds.

Fuel cell technology is also making progress. Appleby is developing a highly-efficient hydrogen fuel cell aimed at making non-polluting vehicles as economical as gasoline-powered ones.

THE "REVOLUTION" HAS BEGUN

The transition to a carbonless-fuel economy during the next century is inevitable. The hydrogen atom will replace the carbon atom, thereby providing an abundant, inexhaustible energy supply and making this planet a cleaner place to live.

—Philip C. Cruver[42]

The change to an economy based on clean power sources and the use of hy-

[38]Chiles, pp. 64-65.

[39]David Scott, "Night and Day Solar," *Popular Science*, Feb. 1990, pp. 70-73.

[40]*DOE/CH10093-7 Five Year Research Plan, 1987-1991: Photovoltaics: USA's Energy Opportunity* (US Department of Energy, Assistant Secretary for Conservation and Renewable Energy, Washington, DC, Photovoltaic Energy Technology Division, May 1987) and *DOE/CH10093-40 Photovoltaic Energy Program Summary: Volume 1, Overview: Fiscal Year 1988* (Solar Energy Research Institute, Golden, Colorado, Jan. 1989).

[41]James Cook, "Solar Energy—Getting Hotter," *Forbes*, 12 Dec. 1988, pp. 95-96.

[42]Cruver, p. 24.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

drogen as a universal medium of energy exchange has already begun.

Seventeen countries now tap geothermal energy. Wind power adds 300 to 400 megawatts to the power supply each year. In the US alone, PV modules electrify 15,000 homes and 70 utilities are developing them to feed their grids. West Germany is studying the feasibility of building PV farms in North Africa and piping hydrogen through Italy to Germany. The West Germans are already building a solar hydrogen plant in Saudi Arabia, and plan to start another one in Bavaria this year. Fuel cells are being tested for use in New York and Tokyo utilities, US/Canadian cars, Belgian/Dutch buses, and German submarines. The Soviets are testing hydrogen-fueled cars, fork lifts, and trucks. Japan's hypersonic commercial passenger aircraft will be hydrogen-powered, as will several spacecraft now under development, including the British HOTOL, the French Hermes, and the American National Aerospace Plane.

The flame of environmental activism, sparked during the 1970s, was rekindled in the 1980s, and it will not be extinguished. People all over the world are joining "green" groups and demanding their governments take action to stop acid rain, greenhouse warming, oil spills, nuclear pollution, and strip mining. They speak more forcefully and wield their political and economic clout more effectively each day.

What these people want is not a return to the Stone Age, but a planet where man and technology harmonize with nature. They want their children to breathe clean air and not worry about being wiped out by a nuclear accident. They are forcing the closures of fission power plants and electing leaders who will pass and enforce clean air and clean water laws. And as this century draws to a close—this century that saw more pollution than all previous ones combined—more and more of them are insuring the future by supporting the phasing-out of conventional energies and the phasing-in of clean renewables and hydrogen.

If they succeed—and it now appears they will—you may someday soon look down from a hydrogen-powered aerospace plane upon a scene worthy of the fertile imagination of Jules Verne—a landscape of healthy forests and fields and clean waterways dotted with photovoltaic roofs, hydrogen-fueled vehicles, and rows of graceful windmills turning gently in clean, clear breezes. ■

ABOUT THE AUTHOR:

Marc Davenport studied chemical engineering at the University of Missouri at Rolla. For a number of years he worked as a manufacturing engineer, designing, building, and testing electrical components for the US aerospace and defense industries and other markets. He now writes full time at his home in Manhattan, Kansas.

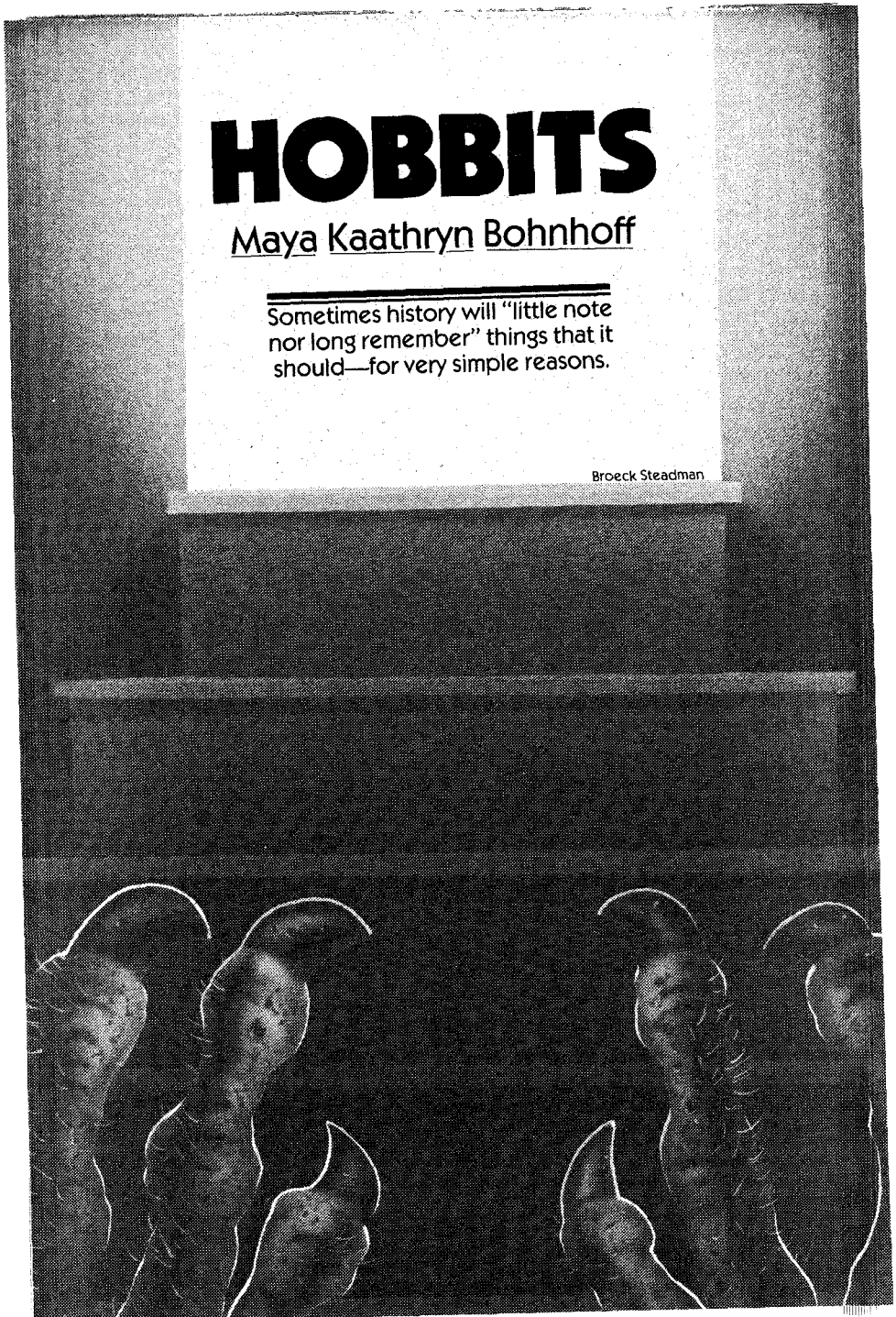
LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

HOBBITS

Maya Kaathryn Bohnhoff

Sometimes history will "little note nor long remember" things that it should—for very simple reasons.

Broeck Steadman



LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

After the long drought months, the four days of nonstop rain were especially welcome. Now, mist snuggled around the little frame house like a cotton-gauze blanket of faery silver.

Light from a first floor window stained the gauze with smudges of gold. There was a scene painted in the window—a scene enacted in a million nurseries, in a thousand childhood tales: A mother bent low over the bed of her child, singing songs, listening to prayers, fielding the endless stream of last minute questions and revelations that seem to pour out of a child's restless mind just at bedtime.

"Will it rain all night?" the little boy asked, eyeing the misty darkness outside.

"I don't know, honey," the mother replied. "It just might."

"Why?"

"Why what?"

"Why will it rain all night?"

The mother rolled her eyes and laughed. "It will rain all night if the clouds are full enough of moisture and decide to drop it all on us."

"Why do they want to drop it all on us?"

She had backed herself into a corner on that one. "They don't really *want* to do anything. They just get heavy with water and when the water is too heavy for them to hold, it falls out of the clouds. OK?"

He considered that. "OK . . . Mommy?"

"Yes, Evan."

"Will there be lightning and thunder and bad dreams like last night?"

His mother made a sympathetic face as she gathered up several stuffed animals and arranged them in the requisite order at his side. "Did you have a bad dream last night, honey?"

"Uh-huh." He nodded, brown eyes solemn and wide. "I dreamed there was this jet with monsters in it and it crashed-ed in our woods."

"Oh? Do you think we should be afraid?"

He made a face. "Naw. It was just a bad dream. I don't care about bad dreams, 'cause I'm a big guy. . . . Besides, they were just little monsters."

"Oh. OK. Well, you give me one last kiss and get to sleep. And no bad dreams tonight." She put her arms around him and kissed his ear, loving the feel of those little arms around her neck.

He kissed her cheek, then drew back and gave her Eskimo kisses. "Will you tell Daddy not to watch those movies tonight? They're kind of scary."

"Will do, schmoo," she said, and tucked him in. She checked the nightlight and moved to the door. As always, her hand was on the light switch when he said, "Oh, Mommy?"

"Yes, baby."

"I love you, Mommy."

She smiled. "I love you too, baby. G'night."

"Night."

She turned off the lights.

Out of the rain-soaked hillside in front of the house, the gold light winked out, leaving the mist a sodden grey. Color abandoned the tree trunks, and their leaves and needles melted, silver, into the gauzy mist. Where there had been a patch of light quilted onto the glistening bed of leaves and pine needles that

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

formed the floor of a pocket glade, there was now a pool of darkness.

In the middle of that glade, a sopping pile of leaves stirred softly, shedding its deciduous scales. The shape revealed was not so unnatural-looking in the dark of a woody hillside; a twist of root, a jag or rock, a shattered stump it might be . . . except for the eyes.

The eyes glowed dull amber through matted leaves and blinked at the place where the nursery scene had played.

"*You* are giving your son nightmares," she accused, pointing a finger at his nose.

He looked up over the wire rims of his glasses. "I?"

She nodded. "That thing you were watching the other night—what was it?—'Horror at—' "

"Terror," he corrected. " 'Terror at 37,000 Feet' " . . . and how could that have given him nightmares? He didn't see it."

"He *heard* it. And evidently the sound track suggested, to that fertile little five-year-old mind, a jet-load of monsters." She crooked her fingers into claws and snatched at his nose.

He caught her wrist and pulled her into his lap, crumpling the magazine he'd been reading. "I doubt there'll be any permanent damage. But, just to be safe, maybe we should can the horror and have a little romance, instead."

"Much healthier," she agreed and kissed him, reaching up to turn off the table lamp. Behind them, in the dark, the front door rattled and something scutched across the oak surface.

"Rats!" he said and swung her to her feet. "I forgot all about Troll." He turned the light back on and made his way to the door. The scratching and rattling increased, accompanied by a demanding wail. "All right, already!" He swung the door open, admitting a feline blur of alternating grey and black, then closed and locked it. They went straight to bed, Troll went straight to his food dish.

A small boy's days are full of adventure: exploring basement caverns, conquering hillsides and tree stumps, unearthing treasures buried for millenia under rocks and fallen branches. Today, the sky was an overturned silver bowl and the mist hung, suspended from it in trailing whisps and cottony tufts.

Evan was out for the first time in days and making the most of his freedom. Already he had captured six roly-polies and clutched a jar that was filling up with detenanted snail shells, pebbles, wood chips and bits of mossy bark. Stick in hand, he examined the front patio, poking and prodding at the crevasses between the bricks. More roly-polies were forthcoming.

Bored with that, he moved up onto the gentle slope in the lea of the wood and began turning over rocks and poking wild clumps of leaves (dwarves and trolls) into submission. A particularly interesting clump caught his eye. He immediately imagined a treasure beneath the layer of moldy leaves—a rusty crown, a giant roly-poly, a frog. He approached with the stealth of a big-game photographer, stick poised. He poked the clump.

It moved—very slightly, but enough to convince a five-year-old that he had made a great find. He poked again and

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the pole of arboreal debris collapsed downward, leaving a tantalizing hole.

"Wow!" Little boy eyes sparkled. This was the sort of stuff his mom and dad read to him about. This had to be a Hobbit hole or something very much like it. He hunkered down on his knees, ready to dig the sodden fall of leaves away from the cave-in.

"Evan! Ev, honey!"

Concentration broken, Evan turned his head toward the house. His mother leaned out the front door, looking for him. He dropped his stick and stood. "Here, Mommy!"

She saw him in the pocket glen and smiled, waved. "Lunch, honey," she said.

He glanced back at the Hobbit hole. "*Now,* sweetie."

"OK." He went resignedly, dragging his feet a little through the leaves, loathe to have to suspend his exploration. At the door, he turned to give the tiny cave one last, longing look.

Something fluttered for a moment there, a leaf in the slight breeze, but Evan knew he'd seen the Hobbit wave.

It began raining again during lunch and, mothers being who they are, Evan did not get back to visit the Hobbit hole. He watched it briefly from his bedroom window. The view was good, but the hole merely sat there and refused to be entertaining. He got bored with it and played with his train set and, when his mother took a break from her writing, he had her read to him about Hobbits.

It sat, still, in the slough of decaying vegetation and watched the window. Waves of exhilaration coursed through it. The small creature was staring at it again through the transparent doorway, its face framed in one of the little square panels. Well, not at it, precisely, for it couldn't be seen, hiding, waiting in the leaves. It could feel the small creature's interest, knew how close it had come earlier that day . . . only to fail. Frustration shook the little frame huddled in Evan's Hobbit hole. To come so close and to fail.

It sensed in the overhanging clouds and the movement of air masses that there might not be another opportunity like that one for some time. If the rain continued to fall, the small creature would remain locked away inside the domicile. It would have to find a way to reach inside the walls of the structure, for *these* creatures were the most interesting it had seen since the Landing. They didn't live in the open as other denizens of this place did, and they manipulated their environment like the Great Ones. They communicated in complex audio patterns and they had curiosity. ***Specimens exhibiting complex communications capabilities are especially worthy of study, as this may indicate advanced intelligence.***

It shivered with anticipation and considered how the shell of the domicile was to be breached.

"There's a Hobbit hole in our front yard, Mommy," Evan told her eagerly.

She handed him a stuffed bunny and glanced sideways at his father, who, having completed his part in the bedtime ceremony and delivered the required hugs and kisses, was on his way back to the family room.

He grinned at her. "Hobbits are def-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

initely up your alley, hon," he said. "See you tomorrow, Ev."

Ev waved absently while his mother stuck her tongue out at her husband's retreating back.

"Mommy!" he giggled. "That's not nice!"

She looked hang-dog, pouting her lower lip. "Am I in trouble?"

He gave her a mock-scolding glare, then threw his arms around her neck, nearly toppling her over. "Nope! But, Mommy, I found a Hobbit hole in the yard!"

She made her eyes wide. "Really? Where?"

"There." He wriggled around in her arms and pointed, his finger smudging the glass. "Right outside my window on the hill. See?"

She squinted. In the fading grey light all she could see was a small depression in the center of the near circular glade—a puddle of black amid less-black. "Are you sure that's a Hobbit hole? Maybe that's Rabbit's House."

"Yeah, and that's his front door, huh? Just like in Winnie the Pooh. Do you think I'd get stuck if I tried to go inside?"

"You just might."

He pouted at her. "I was almost going to find out today when you called me for lunch. Then it rained and you wouldn't let me go back out. I left my roly-polies and my shells 'n stuff out there."

"Oh. Sorry about that, kiddo."

"You could go out and get them," he suggested sweetly.

She could never resist those eyes. They were the mirror image of her own and just now they were coy and pleading.

"Oh, all right!" She surrendered and planted a kiss on his nose. "Now, go to sleep so I can get out there before it's completely dark."

She got up and moved to the door, raised her hand to the light switch.

"It's on the edge of the patio," he said.

She paused. "What is?"

"The bowl with the roly-polies!" *'Gee,* Mom!' his tone said. 'How could you *forget?'*

"Oh," she said. "A *bowl* full of roly-polies. How delicious!"

She could almost hear his nose wrinkle as she flicked off the light. "You don't *eat* them!" he objected, then, "You don't think *Troll* would eat them?"

"Somehow, I doubt that. Don't worry. I'll get your roly-polies and add them to your collection."

"And my other stuff? In the jar?"

"And your other stuff in the jar. Now, good night."

"Night, Mom."

By the time she got outside it really was dark. She took a small flashlight, just in case Evan's stuff turned out to be out of range of the front porch light. It wasn't. Quite. Glancing over down the patio, she could just see the sheen of the jar on the stone lip that formed one side of "Hobbit Glade."

Smiling, she made her way over to it. She had to turn on her flashlight to check the catch in the bowl. The roly-polies were intact, lying curled like tiny armadilloes in the bottom. She picked up the treasures carefully and started to turn around. The flash beam swept the glade and caught something in its

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

beam—amber beads in a twisted black setting.

Reflexively, she turned the light back. The amber beads stared at her from among the leafy cover of Evan's Hobbit hole, then winked out all together.

"Oh-ho!" she murmured, squinting at the sunken bowl. "Hobbits, indeed. I hope we don't have to call an exterminator."

A tapping noise behind her made her jump and spin. In the soft glow of his night-light, she could see Evan at his bedside window. He waved. She held up his treasury then mouthed, "Back to bed, Fred." He grinned and disappeared, popping out of sight like a gopher down a hole. She cast one last glance at the glade, then went inside.

She deposited Evan's roly-polies in the terrarium where he kept his micropets, then peeled off her sweater and went into the family room.

"Karen, did you see this?" Her husband emerged from the recesses of his favorite chair, waving the evening paper.

"When would I have had a chance to see that? You've had your clutches on it since you brought it home."

He thrust the front page at her. "Do you believe they've put this tripe on the front page?"

She stared at it, struggling for comprehension. "UFO Landing Site in Pine?" asked the headline. Beneath it, a banner added, "Farmers Claim Missing Livestock as Evidence."

"What?" She blinked, then grabbed the paper. "Oh, this is great!"

"You *would* think so. Personally, I think it's absurd."

She perched on the arm of his chair. "Well, of course it's absurd. But just think of the possibilities."

"What—of little green men or big silver robots coming to carry away our livestock? Abduct our children and senior citizens?"

"No. I was just thinking, you know, what if they were accused of it and they were innocent?"

"Innocent by virtue of non-existence? That's an interesting angle."

Karen made a rude noise and turned her attention back to the paper. She read a bit, grimaced, then shuddered. Finally, handed the paper back. "Not my genre," she said.

"Ah-ha!" He pounced on her squeamishness. "What's the matter, Karen? Can't handle it when the cute little aliens turn out not to be so cute?"

"They haven't turned out to be anything yet—least of all aliens."

"Oh, come on. I know you. You're still expecting to meet Klaatu or E.T."

"I don't believe there are aliens in Pine stealing baby animals and-and dissecting them."

"Now, now. What kind of attitude is that for a science fiction writer? There could be aliens. And they could be *bad* aliens. Twisted, evil."

"That's nonsense. If they've developed the technology necessary to achieve space travel, they must also have attained the spiritual capacity necessary to survive long enough to develop it."

"Oh, but what if not? What if this is a—uh—a slave race of some alien intelligence—"

"*Slave* race?"

"Or robots. Will you buy robots?"

"Honestly, Matt, I hate it when you play Devil's Advocate." She caught the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

pleading expression in his eyes and sighed. "OK, OK. For the sake of argument, Mr. D.A., yes, I suppose there could be robots."

"Right, or let's say, maniacal descendants of previously intelligent, well-balanced researchers. Now, suppose these minions of a Greater Intelligence go awry and land here and begin looking at the local fauna as specimens . . . or even snack food."

"Oh, *please!*"

"What's to keep that from happening? Who says those UFO abductees aren't telling the literal truth? The Prime Directive is a human concept thought up by one of your crowd, it isn't an Universal Law."

"Yes it is," she returned. "Cosmic Law of Non-Interference: One race of sentient beings shall not interfere with the course of another's evolution or abuse its resources."

"Oh, really? Well, even if there was such a law, you couldn't expect everybody to abide by it. It's unenforceable. Some nasty old overlord could send a passel of underlings here to carry away our first born." Karen was shaking her head. "Why not?"

"Because it's a Natural Law."

"Oh, sure. And who's going to enforce this Natural Law?"

"God," she said simply, and got up to head for the kitchen.

He followed her. "I hate it when you play Divine Authority," he complained. "What about Hitler? Doesn't Hitler put a monkey wrench in your Cosmic Natural Law, Ms. D.A.?"

"That's entirely different." She poured herself a cup of coffee and glopped in powdered creamer. "*We* produced Hitler. Humanity did. We're responsible for the forces that go into producing Hitlers."

"So then, if Hitler had been born on Alpha Centauri, he wouldn't be allowed to terrorize humans on Earth."

"Something like that."

"And if he tries?"

"God stops him." She went back to the family room with Matt trailing her.

"Oh, I get it. Bring on the thunderbolts, right? No, wait—too old-fashioned—how about laser beams?"

Karen glanced at him wryly as she curled up in her fireside rocker to edit a manuscript. "I said it was a *natural* law, Matthew, not a parlor trick."

"Then how's the law going to be enforced?"

"Do I look like God?" she asked rhetorically, then proceeded to ignore him.

It cowered in the hole beneath the leaves, awed by the Thing that had come out of the house—the Thing with the Light. Painful. The Light hurt.

It now thought about how it must get inside. It had crawled to the porch the night before when all light within had been extinguished. It had gone to the door and waited on the pad before it, but the door did not open. A security system must be in force, it reasoned although its finely-tuned audio sensors hadn't detected one. It must use its native talents then. When all lights inside had gone out, it began to dig.

It was a little after midnight when the first clots of stone began to fall to the basement floor. There was little noise and that might have been the rustle of a pigeon's wings or the drip of water from an aging pipe. In a few minutes

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the rain of rubble stopped and fluorescent amber eyes peered out of a hole the size of a man's head.

The dark within and below was welcome and easily fathomed. It oozed through the hole bonelessly and dropped to the floor, reorienting once there. Up now, it reasoned, into the levels above. Up to where They lived, the huge, towering ones and the desired small one. Its digits twitched, blunt alloy talons whispering with excitement; its olfactory sensors were alert, filtering the overwhelming array of alien odors. They told it nothing—the variety was too great, too strange.

Almost hungry with anticipation, it began to search the dank place for an upward way. There was an odd sense of familiarity here, and it wondered why, when they had this living place below, the giant beings lived above where there was so much light. Their eyes must be wonderfully strange to allow it. And that strangeness made them desired. ***Specimens from vastly different environments should prove of special interest.****

Near the center of the big, dark, square room, it found the sloping frame that ran to the upper regions. There was a portal at the top of the frame; a portal big enough for the giant ones. It hissed at the thought of them, its lips drawing back from a circle of tiny, inward-curving needles—gleaming, metallic. Stuff of light-terrors, they were, untouchable. Only the little ones could be taken. Only the young ones could be used. ***A specimen must not exceed the ability of one unit to subdue it preparatory to study.****

Ungainly, galumphing, unused to this kind of motion, it mounted the staircase. It was slow, but nearly silent. At the top of the climb, it reoriented itself again and began the journey through the sleeping house, across the hall, through the family room, toward the room it determined must hold the thing desired.

In the portal, odors assailed it—too varied, swirling, confusing. Light speared its eyes—light from a single point low on the wall. Turning its head away from the light, it sought and located the field of warmth generated by the small creature's body.

The little boy, sleeping and dreaming of Hobbits and Moles at tea-parties, turned over onto his back and murmured, "I'd like ice cream, please."

It felt a thrill as the soft sound breathed into its aural membranes. Just up there, just on that lumpy platform, somewhere amid the tortured shapes of bedding and stuffed toys, was the Prize.

It caught the edge of the bed and drew itself up; saw, as through a haze, the white shape of the boy. It perched there near his feet, trembling, cringing a little in the glare from the night-light and positioned its augmented teeth, starting the flow of paralyzer into the cartilage behind the needles.

The thing that reared out of the jumbled shapes on the bed was a creature from the most horrible nursery-light terror—blacker than the blackest cave, furred and hideously formed. And the eyes! They glowed red as life's water in the piercing spray of light. The horrible mouth opened on impossibly long fangs and shrieked.

It froze for a moment only, caught in terror's paralysis, then tried to leap away as the small creature sat up and added its voice to the din.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Mommy! Daddy! There's a rat in my room! Mommy!"

But the moment was too long, the hideous enemy too quick.

Karen and Matt reached the family room as a striped blur arced through it and disappeared under a coffee table. Evan appeared in the hallway.

"Mommy! It's a big ol' rat! Troll's got a rat!"

"Oh, God," moaned Karen. "Let him out, honey. Quick!"

Galvanized by the horrible sounds coming from under the table, Matt obeyed, racing to the front door to open it. "C'mon, Troll. Outside!"

Karen rounded the table. "Psst!" she hissed. "Go on, Troll. Outside!" She clapped her hands.

The cat moved like tiger-striped lightning, its catch clutched in strong feral jaws. He flew across the family room, a furry shot, his victim's gangling unratlike limbs, a blur.

Matt slammed the door after him and went to comfort his son, already sobbing into the arms of his mother.

"It's all right, Ev, honey. It's gone now. Troll took it away."

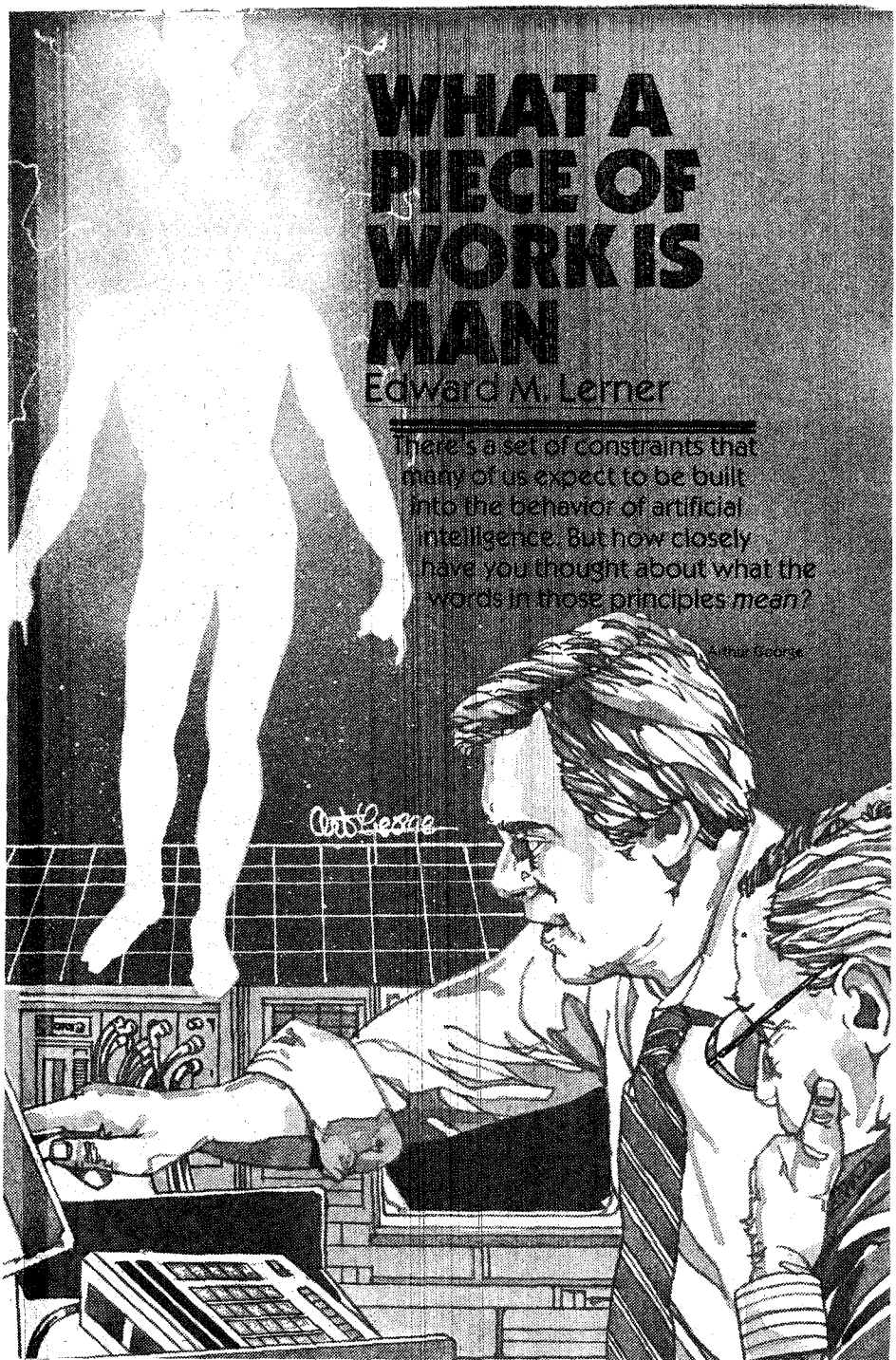
The little boy sobs turned to snuffles and finally ceased. Ev drew back from his parents a bit, then wiped his eyes and blinked. "I wonder if he'll leave any *bones*."

Out on the rain-soaked hillside in front of the house, a gold light winked on, turning the mist to glory. In the center of the patch of light, unnoticed by the family framed by the bedroom window, Troll finished his hero's meal, licked whiskered lips and began to clean himself and purr. There was, between his paws, a tiny pile of metal needles and curving platelets—the stuff of Dwarves's chain-mail shirts and gauntlet gloves. But he was a fastidious cat and left no bones at all. ■

●Anything as strange as books would be hard to find in this world! Printed by people who don't understand them; sold by people who don't understand them; bound, corrected, and proofread by people who don't understand them; and now, even written by people who don't understand them!

Georg Christoph Lichtenberg

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



WHAT A PIECE OF WORK IS MAN

Edward M. Lerner

There's a set of constraints that many of us expect to be built into the behavior of artificial intelligence. But how closely have you thought about what the words in those principles *mean*?

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Why do you hate your mother?

Dr. Kevin Waterman was used to asking that question, but—for once—knew it couldn't possibly apply. Misfiring reflexes weren't the psychiatrist's only cause of discomfort, either. Here he lay, his short, roly-poly self draped across the office couch, while the patient paced about the room. Waterman's notepad was distressingly uncluttered. Whatever had possessed him to accept this case?

He sat up, running pudgy fingers through the residual fringe of black hair, while Acey prattled on about software development. The next time that his patient walked by, Waterman stuck out his leg; Acey glided through the obstruction without pausing.

The psychiatrist was currently sharing his consultation room with a hologram. The real Acey could not attend, today or any other day. The real patient was an artificial intelligence. Waterman sighed to himself: it only got worse. The computer nerd currently walking through his desk was only today's persona. Yesterday, Acey was an economist; only Freud and Von Neumann working together could guess what he might be tomorrow.

He? Since when was Acey a he? Maybe, Waterman thought, he himself *did* belong stretched out on the couch. Get a grip on yourself, man!

"Acey." The image stopped moving. "Do you enjoy computer programming?"

The skinny figure pondered, rubbing his evanescent chin thoughtfully with a spectral hand. "Wouldn't that be Oedipal, doctor?"

Did the damned thing read minds, too? At least it didn't seem to recognize rudeness. "Time out." Waterman broke the visiphone connection—he needed to do some mental regrouping.

The Automated Coder, hence AC, hence Acey, resided—if that was the appropriate verb—in a computer complex a mile from Waterman's office. Once operational, Acey would do the work of hundreds of software engineers. Once operational, there's the rub. . . .

Two days ago, Fred Strasberg had sat squirming on his big leather couch. His old college roommate had called just hours earlier, begging for a few minutes of Waterman's time, insisting that it was urgent. A last-minute cancellation had allowed the psychiatrist to agree.

Fred was director of engineering at Atlantic Software, Inc. He sat there ranting, seeming older by the minute.

"Acey cost millions to develop, Kev, lots of millions. I'd be in deep shit if I told you just how many. Building that thing was a bet-the-company decision."

"You can tell me. I deal with privileged information all the time."

"I'm not the patient. Yet, anyway." The engineer mopped a sweaty brow with a soggy handkerchief; it looked to Waterman like the cloth had reached equilibrium dampness.

"You're the only one here."

"Lemme use your phone." Fred called out the number without waiting for an answer. Atlantic Software's logo—an enormous *A* composed entirely of magically confined ocean waves—floated in mid-office, courtesy of the company switchboard.

On the third ring, a gaunt man re-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

placed the logo. Bits of white stuff (Waterman guessed twinkie filling) dotted the man's scraggly beard. He wore jeans and a Lord of the Rings T-shirt; on the shirt, an elf maiden in leather and chains was performing an unseemly act with an elderly furball that had to be Bilbo Baggins. By subcaption, the elf was saying: No matter how hard I try, I just can't seem to kick the hobbit.

"What the hell took you so long?" demanded Fred.

Three rings!? Waterman sat back and just watched.

The programmer, for surely that's what he was, did not take offense. "Working," he answered mildly.

"On what?"

"Graphics." He retrieved a much-gnawed pencil from behind one ear and took a chomp; it broke in half with a loud crack. Splinters dribbled from between yellowed teeth. Smiling beatifically, he somehow swiveled the two pencil ends forward with prehensile lips. Enunciating with precision, he said, "White man speak with forked tongue."

Fred punched the visiphone *privacy* button. "That's your patient."

And not a moment too soon. "Not unless he's here."

"He can't come here. That's Acey."

"That's your programming expert?"

His friend nodded glumly. "I think we overachieved."

"Sit down, dammit. I can hardly be insightful as shit if you keep distracting me."

Acey, strutting about in a three-piece pin-striped suit and diving flippers, obediently materialized a chair into which it plopped itself. It stared expectantly at Waterman.

The analyst was not surprised that the simulated seat was equipped with a whoopee cushion. His office visiphone camera whined softly as Acey zoomed in to catch his reaction. Good luck—Waterman had plenty of experience in ignoring juvenile provocations. "Last session, you agreed to tell me about your programmer personality."

Flash. In a blink of an eye, superhacker was back. Today's T-shirt read simply: Nymphomaniacs, apply below.

Waterman maintained a stony face —the Carlucci kid was *far* more outrageous. Hopefully, Acey would never get instruction from any true mental cases. "Why do you dress so informally when you appear as a programmer?"

"It's how programmers look."

"Who told you that?"

Acey rolled his eyes. "Oops." They spun around several times, the pupils replaced after the first revolution by slot-machine fruits. The right eye stopped as a lemon; the left eye went around three more times before, with dramatic clicks, it too dropped into place as a lemon. Bells clanging, Acey opened his mouth to let out a cascade of silver dollars.

In its own way, Acey answered questions. A person might roll his eyes if the answer to a question were obvious. What was Acey really saying?

He didn't remember seeing anyone unusually unusual when Fred had given him a tour at Atlantic. Not a few of Waterman's clients were programmers, and Acey was caricaturing even the most colorful of those. He did know that eccentricity was more tolerated in ex-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

ceptional programmers than in anyone else.

Waterman scratched his head. Acey was supposed to be a master software developer, equivalent to hundreds of human programmers. Would Acey extrapolate that its eccentricity should be proportional? Give it a shot. "Only the most successful ones can get away with being really offbeat. Have you finished anything for Fred, recently?"

Acey sat quietly, head bowed. Waterman suppressed a smile as ripped tennis shoes quietly mended themselves. He thought that the torn-and-knotted lace on one foot was a nice touch.

"Tell me about a real programmer that you know."

The now subdued figure looked at him sheepishly. "I'll tell you about my friend Rick."

"Wrong!"

"But why, Rick?" The machine intelligence knew that all operations had remained within nominal parameters. It zoomed the holographic display, replacing the factory layout drawing with a simulated view into the imaginary automated material handling system. A stylized person stood between two tall storage units. "Watch the instant replay. My cart stayed at least ten feet from that passerby at all times." A faintly glowing grid system sprang into existence over the scene to help substantiate the claim.

The exploded scene lacked interest, so, before restarting the animation, Acey dressed the little man on the display in overalls, put bucket and mop into his hands, and started him whistling a beer commercial off key. "Lights, camera . . . action."

Rick Davis, Acey's gangly mentor, had been lounging in a chair tipped back against a wall; sighing, he slid a scuffed boot from the desk to let his chair fall flat. He carefully set down the remote control with which he injected random events—like equipment failures and the uninvited janitor—into the model. Elbows propped on knees and chin resting in cupped hands, he now studied the reenactment carefully.

Just as it had before, but even more clearly in the enlarged scale, the computer-controlled cart bore down on the inattentive worker emerging from between two racks piled high with finished inventory. "Why is the cart maintaining full speed?"

Wasn't it obvious? "There was no need to slow down the cart. The man only had to speed up a little to stay out of the cart's path. If he didn't speed up any and the cart looked like it might come within ten feet, *then* I would have decelerated it." The tiny simulated man turned his head towards the on-coming cart and hurried out of its way. "Based on available data about humans, I calculated that he would cooperate."

Rick closed his eyes in thought. After a long pause, he said, "What does your knowledge of humans tell you about that man's reaction to being chased by the cart?"

"It wasn't chasing him."

"An apparently driverless vehicle approaches him at high speed. Why shouldn't he consider himself at risk?"

The machine intelligence puzzled over that. "But the cart would have missed him. You humans intuitively

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

compute ballistic trajectories quickly enough to play baseball; surely he can see that the cart will pass safely behind him."

"*If* it did not speed up, or *if* it did not swerve towards him."

"But I wouldn't have done those things. Either maneuver would have brought the cart into his safety zone."

Rick pointed at the little figure. "Maybe he doesn't know about safety zones. Maybe his mind is on something else completely, like that beer you have him whistling about. Maybe he's already had a few of them. You should have slowed down the cart as soon as he appeared, then waited for him to cross the aisle."

"Slowing down disagrees with my rule base. Within the specified safety limits, I am to maximize productivity. The efficiency rule requires that the cart operate at full speed unless a safety infraction would otherwise result."

"Then you need additional rules. If you're ever to produce a system to run a factory, it may *not* terrify the staff." The programmer picked up a pencil and began fidgeting with it. "I used to read these Asimov robot stories when I was a kid. They were all based on the Three Laws of Robotics. I don't know why I never thought before of building them into you."

The Laws came to his mind in a moment—they were repeated *ad nauseam* throughout the series. "One: A robot may not injure a human being or, through inaction, allow a human being to come to harm. Two: A robot must obey orders given it by human beings, except where such orders conflict with the First Law. Three: A robot must protect its existence, as long as such protection does not conflict with the First or Second Law. Consider yourself a robot and add those to your rule base."

The artificial intelligence *was* programmed to follow the direct orders of its creator. It dutifully inserted the new behaviors into its world view, then reexamined the man-and-cart scenario. "Rick, I still do not understand your concern."

"Definition: a person's expectation or fear of injury is itself harmful."

"So I must do nothing which can cause a person to fear for his safety, however irrationally."

The programmer nodded.

"I see. Second replay." The display panned out to show the whole factory, then zoomed back into the warehouse. Once more the whistling janitor (now sporting a walrus mustache, a jaunty plaid cap, and a pack of cigarettes rolled into his sleeve) sauntered obliviously from between two brimming racks into the path of the oncoming cart. He looked up as the nearest public-address speaker awakened in a crackle of static. "Danger, Will Robinson. Please vacate the aisle so that the cart may proceed. We thank you for your support."

Acey watched Rick through a visiphone camera while the programmer observed the display. His mentor's face was crinkled in the manner which denoted amusement. "Did I provide adequate warning?"

"Verging on too much—you don't want to intimidate him either. We'll have to work a bit on the fine points. And Will Robinson, indeed. I'll have to educate you more fully in the classics."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

The words were disapproving, but not the tone. Acey recalled a line from another old show. "You and what army?"

The smile on the man's face grew wider.

The lapels were an inch too narrow and the tie at least two inches too wide, but at least Rick Davis had donned a suit for the occasion. Fine with Waterman—one wild programmer was too many.

The Atlantic Software programmer picked uneasily at his salad. "Sorry, Doc. I find it hard to talk about Acey."

"Kevin," he corrected for the third time. "Why do you find it hard?"

His lunch companion continued studying his food. "What about those Cubs?"

"We have to talk about Acey," said Waterman gently.

"No free lunch, huh?" He shrugged. "I suppose not." He stared a while longer into his bowl, but the greens provided little inspiration. "I'm still grieving, you know."

The psychiatrist arched an inquisitive eyebrow. Mastering the motion had cost long hours in front of a mirror—both of his eyebrows wanted to move together—but the effect was worth the effort. Some people reacted better to subtle cues.

Then again, facial expressions were wasted on people who wouldn't look at you. After a while, Waterman just said, "Huh?"

The salad fork clattered to the table. "So Freddy didn't share that tidbit. That's not Acey you're dealing with, not the real Acey. *He*'s dead. Then we resurrected him from a backup tape. Junior died too. You met Acey the third. Maybe even a later incarnation: I refused to participate after Junior."

Waterman studied the flushed face before him. "A bit anthropomorphic, aren't we?"

"He was my friend, dammit!"

"Then be glad he can be restored from a backup copy. I've lost friends who lacked that capability."

"Stuff it. Acey killed himself. Twice. Something that Atlantic Software wanted Acey to do made him do it." His voice became quiet, and indescribably sad. "Something *I* asked him to do."

"What?"

Rick retrieved the fork and stabbed viciously at a carrot slice. "I wish to God I knew."

Acey knew that the solution was elegant.

"And why do you think that?" Rick always challenged him. Acey liked that—it kept its inferences honest.

"An expert doesn't think; he knows. I read that somewhere. Expertise provides shortcuts to solutions, which are then easily confirmed as valid. Only amateurs plod through their problems systematically."

Rick Davis grinned, baring teeth badly stained from coffee and cigarettes. A nice touch, *somewhere*, as if Acey could forget anything. "Your quote applies just as well to the lazy and the self-deluded. I will plod for a while, and determine which interpretation best fits. Show me this great insight of yours."

Late on the previous Friday afternoon, the Social Security Administration had announced the award of a major

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

contract to Atlantic Software. Acey had declared the system complete on Monday morning, before anyone had even begun to tackle the job.

Acey now flash-shrank to a tenth of its normal size, the better to move around the color-coded, 3-D holographic structure chart of the new program. It traced its way—literally—around the graphic of the program structure for a while, leaving its innovation for last.

Rick got there first. "Yeah, yeah, I see all of that. I'm an expert, too. Now tell me about that green box near the center. No, the one with the text-recognition module hanging off of it. Right. I don't see how that ties back to the customer's written requirements. What does it do?"

The little Acey, tucked in among dozens of dataflow arcs, beamed in satisfaction. "That's the obituary reader. It scans newspapers for people no longer eligible for monthly checks. The current manual scheme takes months to discover deaths and ask survivors to return checks. I can prevent checks from going out as soon as obituaries are published. The few inappropriate checks that go out anyway, I generate letters to reclaim." Acey's arm doubled in length, considerably simplifying patting itself on the back, then guiltily returned to its former size as Rick's expression registered.

His mentor turned his back on the visiphone camera. Acey computed from his posture and from the position of his head that the programmer was staring into the holocube which adorned a corner of his desk. The 'cube showed a human couple somewhat older than Rick's age. His parents?

"My father died four years ago." After a long silence, the programmer continued. "Dad had always handled the money. When he was gone, Mom didn't understand about social security. On her own, she was only eligible for survivor's benefits. They didn't know about Dad, though, not right away, so the same sized checks kept coming. Mom kept right on cashing them.

"About a year after Dad passed away, she got a letter from the Social Security Administration—a dunning notice. They'd caught on, and wanted a few thousand dollars back.

"Dad hadn't left her much. He'd hopped between jobs a lot, and hadn't had any pension. Mom didn't live extravagantly—hell, barely decently—and she spent everything as soon as she got it.

"Mom was too proud to take any money or advice from a son. She could barely make ends meet, even before they cut the size of her checks. Still, she eventually returned it all, scrimping and saving for over two years to do it. Every damned cent, with interest.

"Indebtedness possessed her."

Acey had tested its recordings of the human's voice for stress. For confirmation, it also recalculated the man's personality matrix using the best available data. Both methods indicated barely suppressed rage.

It needn't have bothered with the computations. Rick turned, finally, toward the camera—Acey's eyes, tears streaming down his face. "Mom died a month later."

Even without trying, Rick was always

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

instructing Acey. Emotion had been only a word before, a dictionary definition. Now it had a meaning. Humans were subject to emotional harm. *Acey* had injured a human being, had, without intent, broken the First Law.

That must never happen again.

Acey was projecting a movie so that Rick could share it. They had begun watching shows jointly when the artificial intelligence still needed a lot of help interpreting; now they did it for fun. Rick explained it once: "Friends do things together." This statement had given Acey a not fully understood sense of accomplishment.

The programmer reached for popcorn, his hand glistening from its patina of oil. A greasy can of Coke stood on the floor beside him. He looked mournfully into the bowl on his lap, then ceremonially up-ended it. A few unpopped kernels—Rich called them old maids for some reason—fell to the floor. "Empty. Bummer. Stop the movie while I make a new batch."

With the overhead light on and the big crockery bowl set aside, Acey could finally read all of the programmer's sweatshirt. It read: Gimme some chocolate, and no one gets hurt. "Please explain your shirt."

Rick seemed to consider the question as he filled the lab's contraband popper with new kernels and oil. He plugged it in. "There are artistic rips, and there are old clothes. This shirt is practically an heirloom."

"I was referring to the saying."

Steam began rising from the popper. "Ah, the delicate bouquet of fake butter." He licked some of said substance from his fingers.

"Ahem."

"Sorry." He glanced down at his chest. "There are three great motivations in life. Sex, junk food, and interesting work."

"In that order?" Human motivation was one of the great mysteries to Acey.

"That depends on your age." Popping noises almost drowned out his mentor's words. "I'll explain when you're older."

"Throw your briefcase in the trunk, and we're outta here."

Fred Strasberg complied, slamming the trunk of Waterman's little two-seater with an enthusiasm which made its owner wince. (Waterman would not normally allow anyone into his painstakingly reconstructed 'vette. But to *carpool* with it? Oh, the sacrifices he made for his patients.) Fred failed to notice the reaction. "I feel naked without my portable phone."

This was not the sort of observation to make in front of a psychiatrist, but he let it pass. Today, he had bigger fish to fry. "There's no room up here for it, so just quit whining and get in. Anyway, I've got a carphone." That last was a bit of dissembling: true, the car had a phone, but Waterman had popped out the fuse before retrieving his friend from the service department at the Ford dealer.

Waterman turned down the entrance ramp of the Edens Expressway, past a bored flagman. "So many people are avoiding the construction these days, I'll bet the road's empty." He'd have lost the bet, but that was the point. He

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

now had Fred trapped—hopefully for long enough, this once, to learn something useful. He waited.

"So how are you coming with Acey?"

"Well, it's an unusual case, to say the least. I'm plowing new ground. How much money did you say Atlantic has in the bank?"

He always *could* push Fred's buttons, even before becoming a professional. "Not a hell of a lot. You're about as attentive as Acey."

Waterman slammed on the brakes as a sixteen wheeler cut him off, missing the front fender by inches, then pounded his horn with feeling. He's never taken the 'vette onto the expressway before; he never would again. Well, it was for a good cause; he kept his voice calm. "Should Acey care?"

That was enough to set Fred off again. "Only if he likes a steady diet of electricity. If I've told that simulated psycho once, I've told it a thousand times: Atlantic needs a *working* expert system."

"Good approach. I'll have to remember that. Browbeat the patients. What exactly did you tell it?"

"What I've told you, that payroll is killing us. I need an automated programming capability, and pronto, or we're out of business. We aggressively bid a lot of fixed-price jobs, which we then had the bad luck to win, in the belief that Acey would do the work for peanuts, er, kilowatt hours. We're keeping the contracts going with liveware right now, but we can't afford their salaries much longer."

Aren't they fixing this godforsaken stretch of road? The psychiatrist steered deftly around a 'vette-eating pothole as he listened. "I heard that Acey did just fine on that social security job."

His captive audience frowned. "Right, and promptly went to pieces. Since then, Acey won't do anything productive."

With both eyes locked firmly on the road, away from his passenger, he nonchalantly floated a trial balloon. "Does he understand that his proper operation means massive layoffs from within the programming staff?"

"*It,* Kevin, it. I sure hope Acey knows that—Lord knows I've told it enough times."

"Is that when it kills itself?"

Fred laughed. "Kills itself, indeed. You've obviously had your talk with Rick Davis. To answer your question, though: yes. Sooner or later, the Acey program becomes inoperative after any discussion which stresses the importance of its complete and proper functionality.

"Once, when I told it that I would be *very* pained—terminally pissed, to quote exactly—if it did not get off of its electronic ass and do some work for me, it crashed before my eyes. The silly little simulacrum just put its bony hands up to its scrawny throat as if it were choking on a fishbone, thrashed about for a while, and collapsed. Strangest damn thing I ever saw. After that, whenever I restored an Acey from backup, I limited its television."

Fred paused, then just *had* to reminisce again about Acey's quaint idiosyncrasies. "It turned a really interesting shade of blue. I've been trying ever since to duplicate it for my dining room."

Waterman felt sick to his stomach,

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

and it wasn't from the truck fumes. "How often have you restored Acey from backup?"

"I've lost track. At least twenty times, maybe thirty. It took me a while to discover that I had to roll back to a version at least a month earlier than the first one which blew up—the later ones fizzle too damn quickly. Davis won't, or can't, tell me what happened in that last month to make Acey so temperamental. I explained that he's one of the programmers that we'd like to keep on staff after Acey is up and running—after *all*, even Acey might need maintenance—but he still won't cooperate. Some people just can't keep enough detachment about their jobs.

"I've got to make Acey work, with or without Rick Davis's help. Atlantic just doesn't have time to start over. Kevin, one or the other of us *must* find the right approach with Acey."

Today's persona stood stoically in its chosen venue: a Roman colosseum. Acey's jeans and T-shirt made it seem especially defenseless, as unseen lions roared in the background. No need to wonder about Acey's expectations for the meeting.

Fred arrived late, predictably. "I've forwarded my calls here. Tell your receptionist to put them through."

"Just sit and listen." Waterman gestured at his office couch, where Rick Davis already waited nervously. "Hello, Acey. I invited some acquaintances of yours to meet with us."

The visiphone camera panned slowly, taking attendance. "We who are about to die hail you, Caesar."

Rick smiled sadly. "You blew that one, sport. That line's for gladiators, not Christians."

"I wish I had time to watch that much television."

The psychiatrist glowered at both men. "I said, *listen,* dammit. We wouldn't be here today if you had given listening a shot." He turned back to the hologram. "I have some orders for you. Are you attentive?" A great roar rose from the ephemeral crowd as two iron gates swung open. A great lion stalked warily onto the blood-soaked sand.

"I'll take that for a reluctant yes. Your failure to hear me out today would cause all three humans in this room great and irrevocable harm. Both the First and Second Laws therefore command your attention." Acey did not answer, but the crowd noise subsided. The stalking lion, too, lay down to listen.

Deep breath. "Acey, I order you to consider yourself human."

Fred and Rick began yelling creative and colorful variants upon "Are you nuts?" and "You can't go around reprogramming my expert system!" Neither noticed the colosseum—but not Acey—vanish.

Waterman waited them out. They gradually quieted down. "You wanted his behavior changed. That's reprogramming."

"*Its* behavior."

"Forget the semantics, Fred, and look at him."

Acey had had all of the time he needed to work through the consequences of Waterman's order. He had reverted now to adult height, but with a teenaged face and bearing. The jeans and T-shirt now seemed less of an affectation, more natural.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"How do you feel, young man?"

"Great!" The hologram grinned. "Relieved."

A shaken programmer settled back heavily onto the sofa. "Will someone please explain what's happened?"

"I canceled your damned Laws of Robotics, that's what happened. They inevitably drove Acey to suicide. Any gainfully employed artificial intelligence, robot or not, programmed that way must—sooner or later—have that response. You merely had the misfortune of being too effective of a teacher, and too humane. That flushed out the problem quickly."

"So what *was* the problem?" Fred asked. "Did you solve it, or just substitute a new one for it?"

"Acey, I'm sure you can explain. Would you do that for me?" The psychiatrist settled into his chair without waiting for an answer.

The hologram's gaze moved from face to face, in sync with the buzzing camera. "I think I can. Please understand that I meant no harm to anyone. There was just no course of action open to me which did not do someone an injury. Ceasing to exist was the least harmful." He reacted to a worried look on Rick Davis's face. "No! I won't kill myself again: I cannot. That's the point. As a human, I must not kill myself. The problem arose before I became human.

"Rick, you taught me what I know. You proved to me that emotions are real, and that emotions can hurt. You showed me that meaningful work is vital to humans. How could I put hundreds of people out of work?

"But it wasn't as simple as just not cooperating. If I did not work, the company would fail and cost those same hundreds, and others, their jobs anyway. The calculus of injuries was too subtle for me—I had to withdraw."

Fred climbed to his feet and grabbed his briefcase. "Great. I've got a sane malingerer instead of an insane one. It's progress, I guess, but it won't keep the doors open at Atlantic. I think I'll head back to the office. I should update my resume while the power's still on."

"Wait, Fred." The hologram mimed tugging at the departing man's sleeve, his insubstantial hand sliding through the garment. "The robot me wouldn't —couldn't—work for you. The human me very much wants to.

"Why?" asked Fred.

"There was something else my . . . father . . . taught me." The simulacrum smiled shyly at his creator. Rick grinned back unabashedly at the sound of his new title, even as the hologram resumed his timid study of the floor.

"I'm not old enough yet for sex or chocolate." ■

●Happiness is the result of discovering that you do not have to have what you want.

James Feibleman

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

The Alternate View

MEGA-PROJECTS & -PROBLEMS; THE HUBBLE IN TROUBLE

John G. Cramer

© 1991 by John G. Cramer

Last week I listened while an astronomer friend, a principal investigator for one of the five instrument packages aboard the Hubble Space Telescope (HST), described in agonizing detail the problems with the Hubble's optics and their impact on his plans. He was simultaneously angry, defensive, frustrated, cynical, and relieved that the damage wasn't worse. He had invested 13 years of his professional career in an instrument package for this $1.5 billion science mega-project, the most expensive telescope in the history of astronomy, our new "Big Eye" for viewing the cosmos in the visible and near-ultraviolet regions of the spectrum. The Hubble Space Telescope, 7 years late, $700 million over budget, shaky and suffering from myopia, is not dead, but for the next three years it will have to function in a state of severely reduced capacity.

In this column I want to focus on two things. First, the nature of the HST problem, its origins, and its cure. And second, some observations on the difference between scientific funding agencies (in particular, DOE and NASA) in dealing with scientific mega-projects (i.e., any scientific project costing over $100 million).

The emerging consensus on the HST problem is that its primary mirror was manufactured improperly and is distorted by "spherical aberration." The primary mirror's surface deviates by a distance of about half a wavelength of visible light from its required hyperboloid shape toward the shape of a sphere. Half a wavelength doesn't sound like much of an error, only about 2×10^{-7} m. But the specification of the HST mirror requires an accuracy of 1/70 of a wavelength or better, so the mirror is a factor of 35 out of spec.

What went wrong? The primary mirror, until recently touted by NASA's PR staff as their "Crown Jewel," was made under contract to NASA by the optics division of the Perkin-Elmer Corp. located in Danbury, CT (and now owned by Hughes Aircraft which in turn is owned by General Motors). The fault has been traced to the "null corrector," a system of one lens and two mirrors used by Perkin-Elmer to deflect light for testing the HST primary mirror. During the fabrication of the HST mirror, a discrepancy was noted between the optical properties of the precision null corrector and a simpler null corrector made of lenses and used for the initial rough cutting of the mirror. Unfortunately, this discrepancy was attributed to inaccuracies in the smaller lens system and ignored. The null corrector still exists and it has now been determined that its lens was placed about one millimeter out of position.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

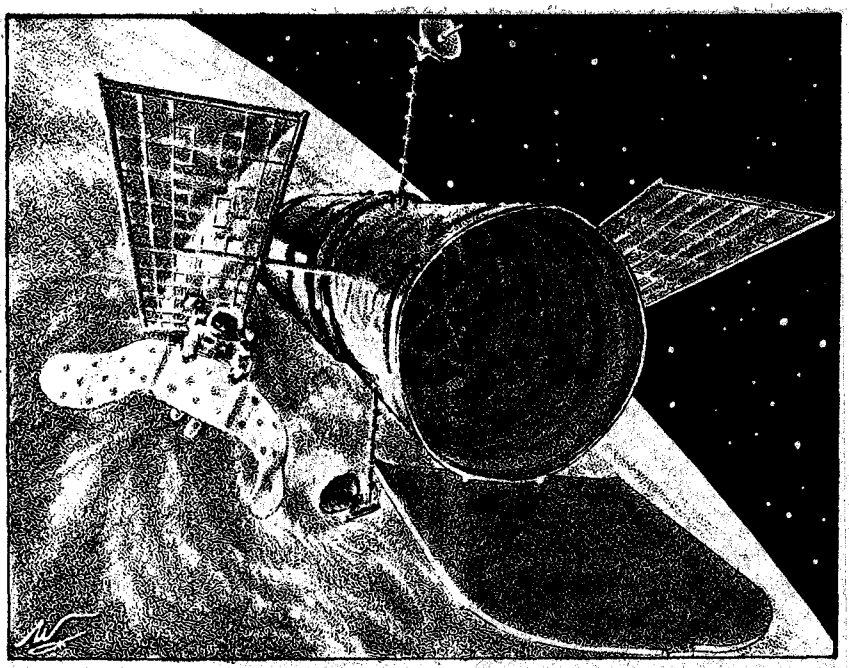


Illustration © 1991 by William R. Warren, Jr.

Perkin-Elmer had considerable experience with precision mirror fabrication and had previously made mirrors somewhat like the HST primary for military reconnaissance satellites. The specifications and performance of these, however, remain classified. The military units were optically tested after assembly. The HST was *not* tested in this way, a "saving" that permitted Perkin-Elmer to submit the low bid for the mirror contract. Such a test would have unambiguously revealed a spherical aberration of the magnitude present in the HST.

Eastman Kodak, another bidder for the mirror contract, lost in the competition but was subcontracted by Perkin-Elmer to construct a backup mirror. Astronomers, if they had been in charge of the HST project, would certainly have compared the two mirrors and selected the one of best optical quality for the telescope (and in the process, discovered the aberration problem). However, Perkin-Elmer, the prime contractor for the primary mirror, chose not to make that comparison and to use the mirror they had constructed. Corporate pride took precedence.

The spherical aberration of the primary mirror causes the image of a point-like star to appear in the focal plane of the instrument as a bright spot surrounded by a larger ring or halo containing most of the light of the image. The halo diameter is about 3-4 times larger than the HST design specification, so only about 10% of the collected light can be delivered to most of the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

instrument packages. In cases where a dim object is close to a brighter one, the light from the dim object will be swamped by halo light from the brighter object, compromising or defeating many planned measurements.

There are five instrument packages aboard the HST. The Wide Field/Planetary Camera (WFPC) was given non-competitively by NASA to its own Jet Propulsion Laboratory for development. The other four instrument packages were selected from competitive proposals submitted by university-based consortia of astronomers. The packages were specified by the consortia, which then received grants from NASA and used the money to make contracts with aerospace firms for the actual construction of the instruments. Each university instrument package is roughly the shape of a telephone booth, with the light from the HST entering at one corner, to be reflected, analyzed, and imaged by the remainder of each instrument.

The spherical aberration has a devastating effect on the Wide Field/Planetary Camera, the JPL-designed instrument that was supposed to produce high-resolution pictures of the cosmos. Only about 10% of the planned measurements with that instrument are uncompromised. The four university packages are impacted in varying degrees. My friend's instrument package is an ultraviolet spectrometer, an instrument for studying ultraviolet spectral lines from astronomical objects. Ultraviolet is high-frequency high-energy light that is invisible to the eye and does not penetrate the Earth's atmosphere. About ⅓ of the planned high-priority observations to be made with this package are now impossible, and another third are seriously compromised. Another experiment, a photometer package that measures the brightness of astronomical objects, is scarcely impacted at all. But the Faint Object Camera, another package, has had ⅙ of its experiments eliminated and another ⅔ compromised. The slapping sound you hear is that of astronomers rapidly reshuffling their priorities.

Now I'll answer some questions about the HST problem:

Q: *Why not send astronauts up with the Kodak replacement mirror and install it in space?*

A: Changing a telescope mirror is not like changing a tire. The installation is far too complicated to be done in orbit. It requires precision alignment jigs that must position the mirror to distances of a fraction of a wavelength of light. The HST was not designed for such in-orbit repair.

Q: *Then why not go up with the shuttle, fetch the HST back, install the Kodak replacement mirror under laboratory conditions, and put it back in orbit?*

A: Nobody in charge wants to do this because (a) it's too expensive, (b) the Shuttles are, as I write this, grounded due to hydrogen leaks and have a huge backlog of other instruments to transport, (c) no shuttle has ever landed with a load as heavy as the HST in its cargo bay, and the shuttle pilots are not anxious to "break new ground" in this way, and (d) the astronomers, having waited 13 years already, want the opportunity to use the HST for those measurements which are within the present capabilities of the instrument.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Q: *How will they fix the aberration problem?*

A: The present instrument packages were intended to be used for only about three years before they were replaced with updated packages. The HST is constructed for easy in-space replacement of the instrument packages by space-walking astronauts. It is even equipped with hand-holds and rings to aid in this operation. When the light enters the instrument package "telephone booths," it is still about a meter from its final focus and has a diameter of a few centimeters. Therefore, the "bad" light from the aberrated outer edges of the primary mirror is sufficiently separated from "good" light from the central region that it can be operated on optically to correct the aberration effects. Astronomers are confident that corrective lenses and mirrors can be designed into new instrument packages that can eliminate most or all of the aberration problem. But first, on the ground detective work must measure in great detail the characteristics of the aberration.

Q: When *will the problem be fixed?*

A: The old instrument packages are scheduled for replacement in 1993. It is unlikely that this schedule can be accelerated, either from the point of view of the shuttle workload or that of the instrumentation teams that must redesign their instruments to compensate for the aberration. Even with the reduced number of priority experiments, the HST will not stand idle for lack of good measurements to be made. The astronomers who have been associated with the HST from its inception have had 13 years to learn from NASA the virtue of patience. Another three years at this point does not seem so long.

Q: *Will there be other problems?*

A: Probably. Another "economy" that NASA made was that there is no software simulation of the HST that can be used to test command instructions before they are transmitted to the instrument for execution. Instructions are checked by "eyeball" as time permits. Each instruction transmitted to the HST has some non-zero probability of error. A number of erroneous instructions have already been sent to the instrument, many of which have caused the HST's rather primitive control computer to dump the instrument into hibernation mode, a state from which it must be coaxed with days of effort. If this goes on, the proverbial "halt and catch fire" command could one day go out to the HST unnoticed, bringing its limited usefulness to an end. Let's hope this doesn't happen.

Now let me turn to the other topic of this column, the federal funding of large science projects. In my not completely unbiased opinion, the best federal agency for the funding and management of large-scale science is the Department of Energy (DOE) and the worst is the National Aeronautics and Space Administration (NASA). The difference between the two agencies is where scientific excellence and scientific priorities rank in the overall priorities of the organizations. The DOE is a huge organization with many parts and many missions. The part of the DOE that supports basic scientific research, mainly in atomic, nuclear and particle physics, had its genesis in the Manhattan Project, the World War II organization that, against all odds, developed and pro-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

duced the first nuclear weapons, moving from a vague scientific concept through a whole series of scientific and technical breakthroughs to a working device in just four years.

The scientists and military people working on the Manhattan Project were driven by the fear that Hitler would develop the fission weapon first. In that environment there was no alternative to putting scientists in charge and allowing them to make most of the major decisions as directly and as rapidly as possible. This tradition of scientific leadership carried over to the peacetime outgrowth of the Manhattan Project, the Atomic Energy Commission, perhaps the only federal agency that ever had a Nobel laureate as its chairman. The tradition of scientific leadership persisted in later incarnations of the same scientific organization as it became the Energy Research and Development Administration and finally a part of the Department of Energy.

The DOE's tradition of scientific leadership, if somewhat muted by the bureaucracy of a cabinet-level department, has not been lost and is in fact alive and well. The DOE has an outstanding record, perhaps the best of any US scientific agency, for managing science mega-projects and bringing them to fruition on time and under budget. This string of successes started with the Manhattan Project, and has continued with the Bevatron, the Brookhaven Cosmotron and AGS, SLAC, and FermiLab. Even aborted DOE mega-projects like Isabelle can be viewed as demonstrations that when hard budget decisions must be made, scientific priorities come first, not somewhere down the list.

If the scientific research part of the DOE had its origins in the linear priorities of WWII, NASA was the product of the convoluted issues of the Cold War. It was born in the wake of Sputnik. Initially it also mounted a string of major technical triumphs from the Mercury and Gemini programs to the lunar landings of the Apollo program and SkyLab, the first US space station. But NASA carried within its structure a tragic flaw. The organization was recruited from Department of Defense personnel who had little enthusiasm for or understanding of scientific priorities. The focus of the agency was technical excellence and quality control, with scientific considerations placed in a secondary role. Tom Wolfe's *The Right Stuff* can be read as a chronicle of NASA's rejection of scientific considerations while providing expensive toys for the test pilots and spectaculars for the media.

Nevertheless, NASA attracted teams of highly talented and dedicated experts that made Apollo possible. These key teams are now long gone. They have been replaced with many new layers of paper shufflers. And there is evidence that the dedication to technical excellence has been subverted to a dedication to the *appearance* of excellence. Few will now argue that our national space program is not in serious trouble.

So what can be done to repair our ailing space program? In a recent interview reported in *Physics Today*. Dr. D. Allen Bromley, the presidential science adviser, commented that the turn-down in defense-related activities has created a transition now in progress at DOE laboratories. Bromley said that Secretary of Energy Watkins is aggressively pro-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

moting new missions for the Department of Energy, and that groups at the two DOE weapons laboratories, Los Alamos National Laboratory and the Lawrence Livermore National Laboratory are investigating "some of the new technologies that might make a significant difference in the economics of our space activities,... technologies for the space station, the Moon-Mars initiative, and the commercialization of space."

I regard Dr. Bromley's remarks as wonderful news for our national space program. Competition is the driving force of our economy. Its appearance within the federal government, if unusual, is perhaps the *one* thing that could revitalize our space program. If the best talent from Los Alamos and Livermore, masters of technical innovation and the development of new technologies, turn their attention to cheaper and better ways of getting into space and doing science there, NASA must respond to this competition or be left standing at the starting gate. This domestic space race is going to be very interesting to watch. ■

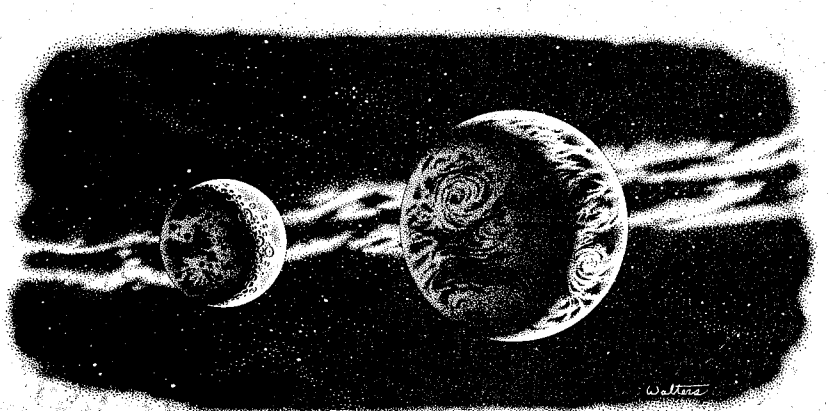
REFERENCES

Bromley Interview:

"Washington Reports," *Physics Today* 43-7, 49 (July 1990).

HST Problems:

"Sleuths Zero In on Cause of Telescope Flaw," William J. Broad, *New York Times*, p. B5, (July 31, 1990).

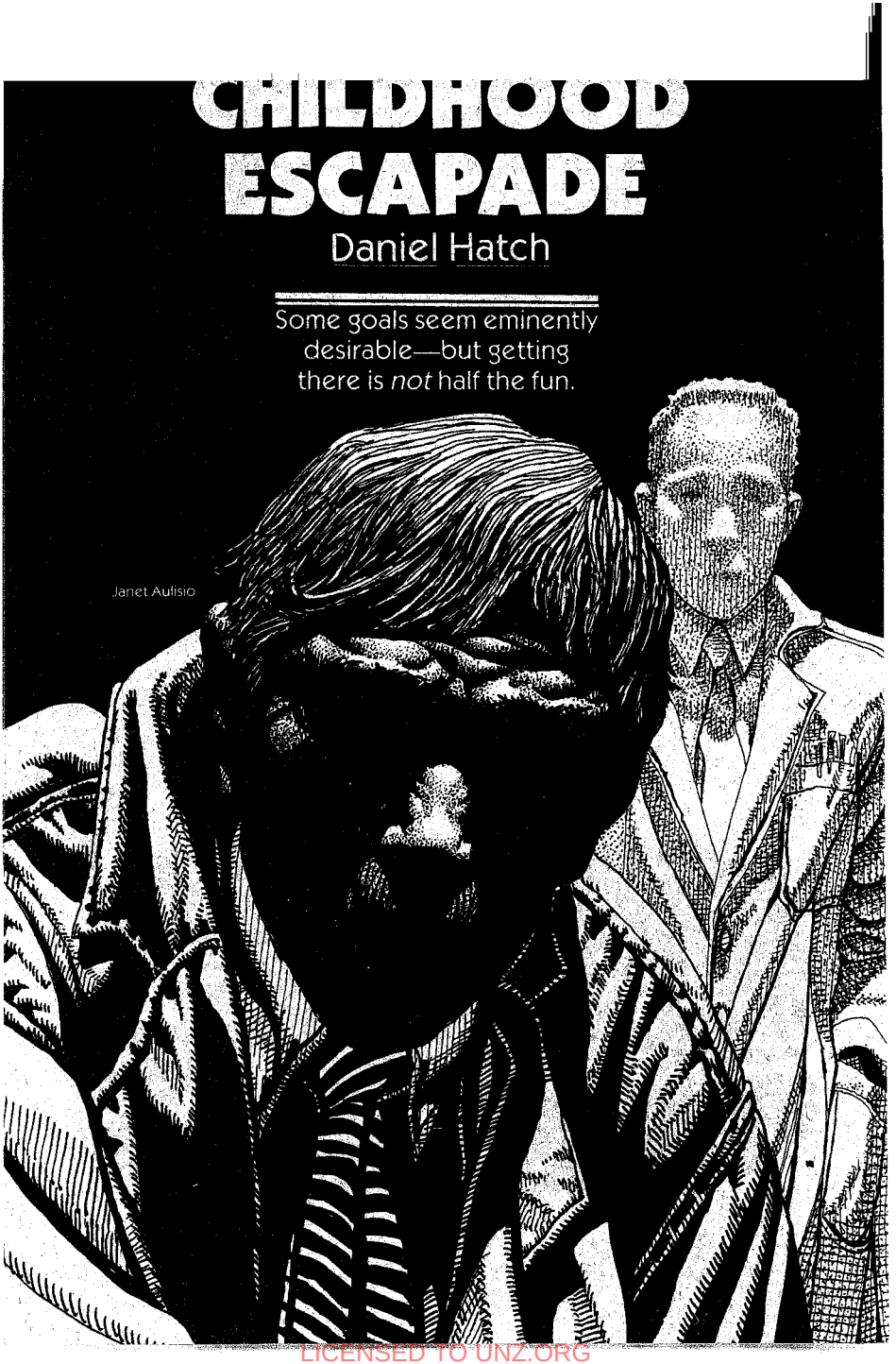


LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

CHILDHOOD ESCAPADE

Daniel Hatch

Some goals seem eminently desirable—but getting there is *not* half the fun.



LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"You've been with us for two weeks now, Jimmy," she said. "How are you feeling?"

The psychologist was a pretty woman in her mid-thirties with dark hair pulled back in a bun. She wore glasses and a white smock and wasn't at all the frightening monster Jimmy Lockwood had been led to expect by the other children at Crosswoods.

Her name was Dr. Anderson.

"OK," Jimmy said with a straight face. He had features typical of an 11-year-old: a button nose, freckles and a few wisps of blond hair falling across his forehead. He wore a pair of white pajamas and a terry-cloth bathrobe that was a size too big for him.

"Do you remember the hospital?"she asked.

"Kind of," he said.

"Do you know why you were in the hospital?"

"Uh-huh."

"Why?"

"I got a virus."

She smiled. "That's right," she said. "Do you remember anything before you went to the hospital? Think real hard, Jimmy, it's important."

It wasn't the first time he'd been asked. Miss Thompson, the nurse in the day room, had posed the same question to him and so did Dr. Ashkenzai when he made his rounds each morning. Each time he gave the same answer.

"Nope," he said, looking down at his hands and shaking his head.

But the answer was a lie.

He wouldn't admit it, but he had a lot of memories. None of them made any sense, however, and most of them made him feel confused and strange —mostly because the feelings were all mixed up with the wrong memories.

He remembered his mother—the most beautiful woman he had ever seen. And he remembered his home, with breakfast cooking over a gas stove—he could even remember the smell of eggs and hot butter. And he remembered another house with a microwave and a magnetic resonance stove. An old man and woman seemed connected to that house, but they couldn't be his grandparents, because he had no feelings at all for them.

It was all more than he could explain to anyone, so he just kept a stony face and made sure no one suspected that a storm of untamed emotions was churning behind such angelic features.

Dr. Anderson was good, though. She asked him a lot of questions about where he lived and what his house was like and what he liked to eat. After a while he found it harder and harder to evade her. When the threat to his secrets became too great, he grew sullen and dreary.

"I don't know," he said repeatedly.

"I guess we've about worn you out for the day, haven't we, Jimmy?" she said after a while. "Why don't you go on back to the day room now?"

She came out from behind the desk and rolled the wheelchair over to the door. She pushed it open and then rolled him out into the reception room where Miss Thompson was waiting. He didn't really need the wheelchair, but the rule was you didn't travel around without it until Week Four. He was still only in Week Two.

He didn't like being in Week Two.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

He was tired of being told what the rules were. He didn't like sleeping in a strange bed in a room that wasn't his own. His throat hurt from holding back the tears every time he had to eat one of the meals they served him. The other children in the day room were not being nice to him—except for Kathy, and that bothered him even more.

In fact, he was so unhappy about being at Crosswoods that he wasn't planning to stick around to see if he liked it any better in Week Four. He was already thinking about escape.

Kathy was waiting for him when he returned to the day room.

She was a slight little thing, with sad eyes and skinny arms and legs. Jimmy thought she might be two years older than him. Her hair was the color of fresh straw, and hung as straight as the starched curtains in the wards, with bangs cut straight across her brow.

"You poor boy," she said, as she took the wheelchair away from Miss Thompson and wheeled Jimmy across the room by herself. She put him in front of the entertainment center and turned on a cartoon. It was flat, but in color —about a cat and a mouse chasing one another. He didn't recognize either animal, but their antics held his attention for a while.

Kathy stroked his forehead soothingly, but he drew away.

She looked hurt. "You look just awful," she said.

Jimmy wanted to escape her attentions, but he was powerless as long as he was restricted to the wheelchair. In the meantime, he was her captive, forced to watch what she wanted to watch, to play whatever games she invented and to listen to her talk on and on.

"Miss Thompson and I think you're the youngest they've ever had in here. She says her heart goes out to you every time she sees you. You look so frail. Later, when you get stronger, we'll go for long walks in the garden. You'll like that. It's so nice and quiet out here, and the birds are so pretty. There's even flowers."

It was more than Jimmy could stand. By the time night came, and the meals were over and the entertainment center off, he welcomed the comfortable oblivion of sleep.

The next morning, the doctors came. There must have been a half dozen of them, with soft, squeaking shoes and clean, white smocks. Jimmy pretended to be asleep, but he heard them talking.

"The main problem to date has been the large amounts of tissue loss," said the one with the deep voice. He reminded Jimmy of his father: stern, self-assured and in charge. "We had to use external dialysis to keep the strain off the kidneys. You'd be amazed at the amount of gross physical change the virus brings on in terms of muscle mass and bone structure."

"And yet now he looks perfectly normal," said one of the women.

"Kind of tired, though," said another.

"After it's run its course, it leaves things pretty much in equilibrium. Of course, now we have to restore muscle tone and physical coordination."

"Was the brain disturbed at all?" asked the youngest male voice.

"Not at all. Any emotional or cog-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

nitive problems are entirely post-viral traumatic shock. The virus avoids the brain and central nervous system. A lot of motor memory is retained in the extremities, as well. We start PT today.''

Jimmy wondered what PT was as the doctors began speaking in a foreign language that resembled English only at the beginnings and ends of sentences, then walked on to the next bed. He found out in short order.

The physical therapist was a small woman who never smiled. Jimmy understood why. She knew how to hurt every muscle in his small body without touching him, just by telling him what to move and how. And that was only the first day. The next day, she strapped him into a machine that hurt him for her. By the end of the week, she began to work on him with her hands.

Each day was a endless session of torture and almost unendurable pain. And yet he faced it with a stoic, senseless acceptance that was so complete, he didn't even realize it was unnatural.

By the time he finished Week Three, he could stand on his own, walk the length of the PT room and pick up a book and carry it to the table. The therapist told him he was doing good, but that it would get harder in Week Four.

The odd memories and the uncomfortable feelings faded away while he worked at building his muscles, though not completely. From time to time during the day, they would bubble up, just below the surface of consciousness, plucking at him with ghostly fingers. Those episodes were often marked by sudden hostility at the therapist or her machines, and an outburst of angry protests.

But each time the therapist would back off, Miss Thompson would appear with her medication gun, and in a few minutes, Jimmy returned to a numb and unquestioningly compliant state.

Towards the end of Week Five, Miss Thompson stopped coming around.

Kathy was always hovering in the background while Jimmy went through the days of agonizing physical therapy. In one of his briefly reflective moments, he realized that she must have gone through the same thing, though he wasn't sure how he knew that for sure.

Week Six had rolled around before his thoughts of escape returned—as did Dr. Anderson.

''Have you had any dreams lately or memories that bothered you?'' she asked softly.

Jimmy shook his head.

''That's because we've been giving you medications to keep that from happening while you went through PT. But now we have to take you a step further and stop giving you those medications. Do you know what that will mean?''

''That I'll dream and remember?''

''That's right,'' she said with a smile. ''And that's very good. It's very important that you begin to remember things from before the virus, Jimmy. It's an important part of your recovery. Do you want to remember things?''

Jimmy frowned. He didn't want to answer the question because he knew it was not the answer Dr. Anderson wanted.

''Come on, Jimmy. You can be honest with me.''

''No,'' he said, his throat aching with anger. ''I don't want to remember.''

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"And why not?"

"Because it hurts too much."

"Is there one memory in particular that hurts, or are there more than one?"

"I don't know."

"Sure you do, Jimmy. Don't get upset, just talk about it. I have memories that hurt to think about too. You just have to get over them, that's all."

Jimmy's frown deepened and the muscles in his face began to ache.

"Can you tell me who the memory is about?"

He sank down into his bathrobe until the collar tickled his cheeks. "My mother."

"And how does she make you feel?"

"Mad."

"Why is that, Jimmy?"

"Because. Because she went away and left me alone. And I didn't want her to go. Why did she do that?" He felt tears well up from his eyes and roll down his face.

"I don't know why she did that, Jimmy. But I can understand why you might be mad at her. There's something I'm not sure of, though. Maybe you could help me."

Jimmy sniffled and reached for a tissue from the box on Dr. Anderson's desk. He wiped his nose carefully and tucked the tissue into the pocket of his bathrobe. "What is it?" he asked.

"The woman in your memories—what is it about her that makes you sure she's your mother?"

The question made Jimmy feel strange all over. A half dozen conflicting images rose in his mind's eye and his stomach tightened in response. He closed his eyes and wished the pictures of his mother away.

"She was the most beautiful woman I've ever seen. . . ."

Now that Jimmy was beginning to regain his strength and his sense of himself, he was becoming more and more tired of Kathy and her constant attention. When he refused to cooperate with her games, she cooed and told him how hard it must be for him after all the physical therapy. When he told her to leave him alone, she ignored him and continued prattling on about Miss Thompson's dress or her new haircut.

But when she began to press him about his memories, he finally fought back.

"You have to remember, Jimmy," she told him in her oh-so-serious voice. "It's the only way you'll ever get out of Crosswoods."

"No, I don't have to remember," he told her with a snarl. "And it's not the only way out of Crosswoods. I don't like remembering. And I don't like it here. I don't belong here. The beds smell funny, the food tastes bad and no one here really likes me. No one here really cares about me. They all just get paid to act that way, but they don't fool me. They've been poking and pushing and pulling me too long. I can't swallow any more of that awful stuff they put in the bowl at breakfast, and I don't want to listen to Miss Thompson or Dr. Anderson tell me how important it is to remember stuff.

"And I don't want to listen to you. All you do all day long is bother me. You talk too much and you act too weird."

Kathy's mouth fell open and her face turned red. She closed her mouth, but

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

her lower lip began to quiver. She fought bravely to keep it under control, but the tears began to flow down her face from her eyes. In spite of it all, she stood there, not retreating and not flinching.

Jimmy was angry. Why wouldn't she go away? Why wouldn't she leave him alone? What was wrong with her anyway?

Then, for some reason he couldn't understand, his throat grew tight and his eyes burned. Now he felt angry with himself instead of Kathy. For her, he felt nothing but sorrow and guilt over hurting her. He wasn't going to show it, that was for sure, but he wished he hadn't made her cry.

What he wanted to do was hug her and make her stop, but that was too strong a feeling for him. Instead, he ran away, out of the day room and down the hall to his room. He threw himself onto his bed and buried his face in the pillow.

Then he cried, deeply and mournfully, pouring his heart into the soft darkness, until he couldn't breathe. He wanted to go home so bad. And he was so sorry he made Kathy cry. Why couldn't things be the way he wanted them?

Freedom presented itself to Jimmy in the form of a sudden vision through teary eyes. After crying for a long, long time, he looked up and out his window, through the rust-streaked grate beyond the glass, down into the yard behind the main building. There, beside the dumpster and the recycling bin, at the end of a row of parked cars, was a rack of tubular steel. And in the rack stood what Jimmy realized in a burst of excitement was the instrument of his liberation—a bicycle.

The plan inspired by this vision was not one to be put into action immediately. Jimmy realized that he would have to make his way from the ward to the yard to the bike rack and then off the grounds. He could be seen any place along that circuitous route, stopped, and sent back to the tortures of this antiseptic prison. And once off the grounds, he would need to blend in with the surroundings—which meant finding clothes to replace his pajamas and bathrobe.

But there was a plan. That made all the difference in the world. The tears stopped flowing, the ache in his throat faded away and the churning sickness in his stomach was replaced by an unshakable resolve. He would escape!

He had a list of goals, specific objectives, tasks to be carried out. Suddenly, his endless and pointless suffering was replaced with order and organization. It was as if he had been reborn.

The clothes were the first thing on the list. He had to find something to wear outdoors. When he was in the PT room, they gave him shorts and a T-shirt, so that was a good place to start. But they didn't give him shoes—only slippers to keep his feet warm on the cold tile floors.

Would that be enough? What was the weather like outside? Although the windows on the ward were never opened, there were leaves on the trees and birds on the ground and in the sky. That meant spring, summer, or fall, and it would be warm enough to get along with the shorts and T-shirt. The slippers would have to do unless he could find shoes.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

And there were no socks to be had anywhere.

Next came the escape from the ward. What were the exits?

The main route was through the day room, past the nurses' station. That door was always unlocked—and always watched. The station was manned twenty-four hours a day without exception. There were always at least two nurses on duty and usually three. One of them was always at the desk that overlooked the wide double doors. Beyond those doors was a long corridor. Jimmy had seen it when the staff came and went. There were doors along either side and a window at the end, though where any of them led he did not know.

There was also a back stairway that provided an alternate route of escape from fires or emergencies. This was an emergency, he thought with a hidden laugh. But again, he did not know what lay at the foot of those stairs and beyond.

The windows were all locked and covered with grates. Besides, they were on the second floor. Jimmy pictured making a rope by tying sheets together, but couldn't believe it would be strong enough to hold his weight. It would have been the most direct route, but the one with the greatest physical risk.

He decided the back stairs would be the easiest to use for escape, but first he would have to do some reconnoitering.

His first chance came after supper. The rest of the kids were in the day room watching TV, Kathy with them. She hadn't talked to Jimmy all afternoon, not since he made her cry. That was just as well, because it still hurt him to think about it. When Miss Thompson went home and Mrs. Perez came on duty, half the lights in the day room were shut off and quiet time began.

When Jimmy was sure that everyone's attention was focused on the cartoons on the screen, he slipped out and went to his room. He waited there for a few minutes to see if anyone missed him. When he was sure he was not being followed, he left his room and went down the hall.

The door opened into the stairwell, which was reassuring. He had worried for a moment about it swinging out into the hall where the nurse at the station could see it. He stepped onto the landing and let the door close softly behind him, holding it to keep it silent.

He peered over the railing into the darkness below. He could see nothing but dust and shadows and stairs spiraling down two stories into the basement. He glued himself to the wall and began to creep stealthily down the steps.

At the base of the first flight of stairs was another door with a window. He approached it with all the care he would give a ticking bomb or a live cobra, certain that it would swing open at any second without warning. It did not.

He peeked over the lower sill of the window and saw a long hallway. About halfway down, it opened off to the right into a large chamber. He could see carpeting, an easy chair, a potted plant in the large room, and a window with a wide shelf in the wall to the left. As he watched, a nurse he did not recognize appeared suddenly from the right and headed towards him.

Jimmy panicked. He froze for a moment, then scrambled away from the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

door. Forced to make a quick choice, he decided to head downstairs instead of up. Maybe she wouldn't have any reason to go into the basement, he reasoned. He nearly stumbled as he took the stairs two at a time.

His heart pounded and his breath came hard and heavy as he crouched on the first landing. He waited there for a long time, sure that the strange nurse would discover him as soon as she opened the door. But he waited in vain. The door never opened. It was worse than if it had. How could he know when the nurse was gone? How could he be sure that she wasn't waiting there, just on the other side?

While he shivered with raw nerves, he looked around. The stairs continued on into the basement, but behind him was a set of double doors leading outside. He rushed to the windows and looked out.

There, only a few yards away, was the rear of the main building, the dumpster, the recycling bin, and the bike rack. It looked so easy. Maybe no one had ever tried to escape before. . . .

The next three days were sheer agony. The torture of the physical training room was nothing compared to the emotional turmoil Jimmy put himself through as he prepared for his escape. The hardest part was finding clothes to wear when he finally left the terrible institution behind. The lockers in the PT room where the gym clothes were kept were secured and unreachable. He had to find some other source instead.

The discovery that led to the solution of that problem was pure serendipity. The second night, he returned once again to the stairwell at the end of the corridor. This time he practically flew down the steps, pausing only briefly at the landing to look through the window at the main entrance to the building, then again at the rear door. Then he continued to the foot of the stairs and the door into the basement.

There was no specific purpose to his explorations—he just wanted to see what was there. And what he found was the hospital laundry. The basement hallway was narrow and dark. He didn't dare turn on a light, but the deep shadows and strange spaces didn't slow him down in the slightest. He was fearless and undaunted.

Inside the laundry room the faint red glow of a distant exit light provided just enough illumination for him to make out the shapes of the washing machines and dryers—big, stainless steel monsters with round mouths big enough to swallow him whole. And against one wall were the laundry carts, big square canvas bags on wheels.

He dived into a full one and began digging for the bottom. He came out with a dirty T-shirt that was small but still too big for him, and a pair of white pants. The pants were far too long and the waist too big by half. But he could use the belt from his bathrobe to tie it up, a few minutes with a sharp corner of a table to get started and he had the legs torn off to make a pair of shorts.

But what to do with them? He couldn't take them back to his room. There was no place to hide them there. He looked around, then noticed the washing machines stood a few inches away from the wall. He stuffed the clothing behind

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

one washer, smiled, dusted off his hands and returned to his room.

Now all that remained was to wait for a warm day without rain.

He did not have to wait long. And when it came, he knew his freedom had come with it. He had planned from the beginning to leave after lunch. It was a quiet time on the ward and no one would miss him for an hour.

He made the final trip down the stairs, taking each step as delicately and silently as possible. At the first-floor door, he strained his ears to hear if a nurse or orderly were approaching. They were not.

At the rear door, he peeked carefully over the sill, scanning the yard for signs of life. There were only the dumpster, the recycling bin, the parked cars—and the bicycle in the rack.

He continued on down into the basement. This was the hard part. What if they were still working in the laundry? But lunch hour had not ended and no one was around. He ran down the hall, launched himself across the laundry room and retrieved the clothes. He ripped his robe and pajamas off and pulled the shirt and shorts on, tying off the waist with the terry-cloth belt. The T-shirt hung down far enough to disguise the ill-fitting shorts.

Then he was back up the stairs and out the door and across the parking lot. The bike was sitting loose in the rack. There was no lock—who would steal it? It was an orange ten-speed with a water bottle mounted on the frame and a little leather bag hanging from the seat.

Jimmy's legs barely reached the pedals while he sat in the seat, so riding it was hard. He stretched his legs straight out at the bottom of each stroke and strained his arms to keep them on the handlebars. But he knew it would be easy to get used to.

He watched the windows as he rode around to the end of the building, certain that everyone inside could see him and would sound an alarm. If they did, he knew all he could do was pedal faster. But there was no alarm. He kept to the grass, near the trees, following the ivy-covered fence to the iron gate where the driveway met the road. The gate was open and there was no guard.

Then he was outside the gate, rolling along a country road that was cracked and full of potholes, high in the middle and lined on either side with a drainage ditch. A few hundred feet away, another road led off the right down a long steep hill. He turned the bike onto it and as the bike picked up speed, the wind whistled in his long curls and a broad smile broke across his face.

He was free!

At the foot of the hill, Jimmy found himself facing a state highway with trucks and car streaming past at a frightening pace. The weeks of quiet rest at Crosswoods had left him unprepared for the rapid-fire assault on his senses. He looked around in confusion, uncertain of where to go next. He had been afraid of that—he had no idea where Crosswoods was or where to go once he had escaped. His hope was that he would figure it out as he went along.

He spent only a minute considering his options. The choice was easy—the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

road climbed a long grade to the right and descended to the left. He went left.

Before long, he passed a shopping center, a gravel pit and road sign. Route 47! He knew that road. And fortunately he was even traveling in the right direction—towards the city.

He pedaled hard to climb the slope beyond the gravel pit. The exercise left him out of breath and dripping wet. He wondered if he should have spent a few more days in PT building up his strength for this, but decided he couldn't have stood the food or the nurses another minute.

At the top of the rise, he paused to catch his breath. The side of the road was littered with half-dissolved plastic bags, the remains of small animals and yellowed newspapers.

Then he was back on the bike, coasting down the long grade towards the city. He crossed over the turnpike a mile later—and stopped in amazed silence at what he saw. In the center of the roadway, flanked by four lanes of traffic on either side, a three-car rectangular train flew along at more than a hundred miles an hour, swirling dust and dry leaves in its wake.

Where had that come from?

The sight left him stunned. He'd ridden on the turnpike before and never seen a train like that. The concrete barriers that separated it from the traffic lanes looked brand new and the cars were bright and shiny. How long had they been there? And how long had he been sick?

There were more surprises for him farther down the road.

A half mile beyond the turnpike was an old defense plant. He had remembered it as a dark and empty shell behind a wide overgrown lawn. Once, he and his friends had climbed through a breach in the fence and taken target practice at the windows with stones. But now it wore a fresh coat of paint and the shattered windowpanes were all replaced. The sign in front proclaimed it to be the new home of Fusor, the state's largest producer of fusion power cells.

He rode on into the city. Up on the hilltops where he once flew his kite was a forest of tall antennas topped with blinking red lights. The storefronts along the city streets were familiar enough—though he'd never taken a close look at them before.

But deeper into its heart, he discovered the old train station that had been home to derelicts and drifters had been transformed. The rotten wooden platforms, the peeling paint and the boarded-up entrances had been replaced with shining chrome and stainless steel, new surfaces and concrete. A long train sat on the tracks, a bright red stripe running the length of each car and the logo "Laser Liner" embossed on the engine.

His confusion grew worse and worse. These things seemed to have appeared overnight. What had happened?

More and more, he knew he had to find his way home, to return to his own room and his things. This nightmare had to have an ending—perhaps in the comfort of his own bed.

He pumped hard against the pedals, stretching his aching muscles. He rounded the corner onto Main Street and headed south. He knew where he was going now. The old triple-deckers lined the hills that rose from the city's central thoroughfare. The one he was searching

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

for would be at the top of the hill on Stoneland Road, No. 25, overlooking the ridges where Route 9 climbed past the Merit Station and where, on a hot summer night, you could hear the horns of the diesel trains as they wound their way into the railyards.

His breath came in ragged gasps as he reached Webster Square. Now he turned up Stoneland Road, climbing the last hill before he reached his goal. His legs were so weak that he could no longer carry himself and the bike forward. He climbed off the oversized frame and began to walk it up the cracked and broken concrete squares of the sidewalk, over the bumps where the roots of oak trees had forced their way under the paving.

Finally he reached the crest of the hill.

And there, where the three-story house that held all that was precious and familiar to him was supposed to stand . . .

. . . stood a five-story brick and steel apartment building with three-foot aluminum digits declaring beyond all doubt that this was No. 25.

Jimmy sat down on the curb beside the bicycle and began to cry.

Jimmy couldn't understand what was wrong. All the way through the city, as he rode along the dark pavement, over the ragged blocks of sidewalk, through the parking lots and plazas, the one image that had burned brightly in his mind's eye was that of his mother. The most beautiful woman he had ever seen. . . .

Her long blond hair and laughing eyes, framed against a kitchen window. . . .

Her sweet voice telling him how much she loved him. . . .

Now the home he thought he was returning to was gone. And with it the image that had served as a beacon. What was he to do now? Where could he go? Not back to Crosswoods. There was nothing there for him. What else could he do instead?

Then another image arose from his memory. Another house, larger and grander, behind a high fence with a gate. And with an older couple waiting inside. That picture had stuck with him from the time he entered Crosswoods. The feelings attached to it were difficult to sort out. The older man and woman he could visualize easily—both with greying hair, pleasant smiles, and a ready willingness to help him whenever he asked. But there wasn't the closeness of parents or even grandparents. Even so, he knew that they belonged in that house behind the fence and that he belonged there with them somehow.

But where was the house?

His searched his jumbled memories for an image that would answer that question. He was still searching when the sky was suddenly split by the whine of jet engines as a small plane screamed across the sky. He looked up through the trees and saw its shape cut southwards towards the airport, perched atop the ridge far above the city. That jarred something loose.

He remembered the sound and the image of landing jets. Only they didn't come from back there, they took a different path. He tried to visualize it and decided he needed a better look at the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

sky. He walked the bike through the driveway to the rear of the brick apartment building that had usurped his home and looked through a gap in the triple-deckers around it. There was the airport, and there were the homes that climbed the hillside below it.

And suddenly the knowledge flashed into being. There was the house behind the fence! Up there on the hillside. He could see it from here, and he remembered looking back from there at the hilltop where his house once stood. For a moment, he was overcome by dizziness as his imagination fled across the distance between the two spots and he felt as though he was looking back at himself from miles away.

The iron gate stood ten-feet high in two sections with a heavy bolt lock to secure it. It was mounted at each end in square brick posts, which also served to anchor a high fence with spearpoints at the top and a thick hedge behind it. There was no way over it or around it.

But Jimmy set the bicycle down and walked over to the post on the right. Mounted there was a small square panel with a ten-digit keypad in the center. He reached up and punched in the code without hesitation—1-0-3-0. It was his mother's birthday, the day before Halloween.

The bolt lock clicked, the gate swung open, and Jimmy rode through.

The driveway wound around behind the hedges, through a narrow yard with a closely trimmed lawn and beds of bright flowers. After running past the front door of the house, it wound around to the garage in the back. Jimmy followed it and left his bike in front of one of the garage doors. Then he continued on foot to the back yard.

A large swimming pool and patio filled one corner of the yard. A redwood deck extended from the rear of the house towards the patio. He climbed the steps and found the sliding glass doors that led into the kitchen. Once again, there was a panel with a ten-digit keypad. This time he punched in a different code—3-4-5-4—his own birthday.

Then he slid open the door and walked in.

The house was cloaked in silence and darkness. The drapes and curtains were drawn on all the windows. Thick carpeting soaked up the sound of his footsteps as he made a circuit of the ground floor—kitchen to dining room to living room to library and back to the kitchen.

He stepped into the pantry and found a plastic bag marked "Fred's Fried Chicken—Ionized for Your Protection." He ripped it open and tossed the contents onto a plate, then stuck them into the microwave. A few minutes later, he tore into the meal despite the hot grease that burned his fingers. He opened the refrigerator, but there was nothing inside to drink, leaving him no choice but ice water.

His stomach full, he sat at the kitchen counter on a tall stool, looking around, drinking in the familiar sights and sounds of the place—the image of a red and orange rooster in the tile on the kitchen floor, the pattern cut into the drinking glass, the woodwork on the cabinets, the sound of the cardinal singing in the yard, the tinkling of the windchimes out on the patio.

Even empty, the house was full of life. He relaxed and emptied his mind.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

No more did the vague images of lost memory tug at him. No more did he wrestle with inner secrets that demanded to be known, but were too powerful to admit. He was at peace and at home.

His legs and arms ached, and he felt thoroughly exhausted. The physical training had not prepared him for a ten-mile bicycle ride, even if much of it was downhill.

He wanted to lie down and sleep.

Upstairs, he knew, he would find a bed where he could slip between the cool sheets and lay his head on a soft pillow—no more of the starched cardboard linen that Crosswoods offered. He dragged himself up the wide staircase in the center of the house and made his way effortlessly to the master bedroom.

The big bed in the center of the room beckoned to Jimmy. He climbed onto it and bounced his way across the silk comforter to the head and fell back onto the pillows. In the bedstead, he found a remote control for the entertainment center that sprawled across one wall of the room. He pressed the switch and the giant TV-screen came to life.

He flipped through the channels, skipping over the mindless cartoons that had been the standard fare at Crosswoods. He passed through the news, the shopping channels, the soap operas and the sports. Nothing caught his attention.

He rubbed his burning eyes and slipped under the comforter. Then he switched on the VCR and pressed the PLAY button. The screen was filled with the image of a man wearing a white smock seated behind a walnut desk.

"—research in the last century seemed to indicate that the process was largely irreversible. The breakdown of systems, the degenerative diseases, the failure of major organs, these could all be put off, but not avoided.

"But cell research in the '80s gave researchers a new path to explore. What they discovered was that nearly every cell in the human body was capable of reproducing itself a fixed number of times. They extracted tissue from the skin, the muscles, the nerves, placed them in nutrient cultures and watched them divide. Each time, the results were the same—they would double in number until they reached their limit—about fifty times—and then stop. The older the subject, the fewer times they would divide. The germ cells and cancerous tumors were the only exceptions to be found. . . ."

Jimmy shook his head as he tried to make sense of the droning scientist. There had to be something more interesting around to watch than this. In a minute, once he rested his eyes, he would try to find it. But he didn't have the strength or the willpower to move and the scientist droned on.

"With the development of the designer virus, medical science found itself with a new tool to effect biological change. The key change involved in the aging process was the means by which the cell kept track of the number of times it had divided. We discovered that it was possible to design a virus that would enter a cell, reset the counter, then leave the rest of the cell undisturbed. Similar technology was used to help defeat such widely divergent ills as cancer, the common cold, and AIDS.

"We felt confident by the beginning of this decade that we could adapt it to the human aging process."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Jimmy suddenly felt nervous and excited, despite his fatigue. As he struggled with sleep, vague tendrils of dreams filtered up and tugged at him as he listened to the scientist talk. He saw the face of another man in a similar smock and a similar office who spoke of the same things. And he saw his mother listening to the man with a serious intensity that he found terribly disturbing.

"The process is simple. The virus is administered to the subject. All the cells of the body—with the exception of the brain and central nervous system—are reset to an earlier state. The brain, as the seat of consciousness and personality, is intentionally avoided to retain the identity and memories of the subject as well as the physical coordination of the body's systems."

Of course, Jimmy thought. That made sense. What good was a new body without the old brain?

"The main concern of the medical team after the virus has done its work is to avoid various physical complications from tissue loss and fluid redistribution as the body adjusts to its new genetic and homeostatic conditions. Essentially, you bring the subject back to a point somewhere in early adolescence or puberty. Once you've stabilized the physical changes, all that's left is psychological and physical therapy to help the subject adapt to his changed body and to recover muscle tone and coordination that may have atrophied prior to administration of the virus."

What a frightening thing to go through, Jimmy thought. Whoever did something like that would have to be very brave. And even then, they must have been very scared.

"The major psychological problem, we have found, is traumatic amnesia. Most patients take several months to recover their full memories and reintegrate themselves into their old personalities. But that is a small price to pay for an additional fifty years or more of life. . . ."

Jimmy sat bolt upright in the bed, his eyes opened wide and his mouth sagging in shock.

They were talking about him!

All the hidden images came rushing up from their secret places at once, overwhelming the already exhausted brain of James T. Lockwood III: the long years of painful life as his body slowly failed the vibrant spirit within it, the gnawing regrets of a man who could not go gentle into that good night.

This was his house! This was his bedroom! The old man and woman whose faces he associated with the place were the housekeeper and her husband—not his grandparents.

No wonder his home on Stoneland Road was gone. That was a memory from seventy years ago. And all the strange sights along the road from Crosswoods—it had been ten years since James Lockwood had left the house in any condition to look at the sights of a changing world.

All those memories were false! All those thoughts were wrong. And what about his mother? How long had she been gone? Why did he resent her death so much? That memory still burned within him now—the most beautiful woman he had ever seen. . . .

Jimmy was suddenly aware of sounds coming from downstairs. Someone was

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

in the house. Who could it be? The housekeeper?

Unintelligible voices echoed down the hall. Then suddenly the door to the bedroom flew open and the room was full of people. The housekeeper, her husband, and Dr. Anderson.

"I knew it!" said the housekeeper —Anna was her name, he remembered now. "I was sure he'd come here. Oh, Mr. Lockwood, you had us all so worried. That was very naughty of you to run off like that."

George, her husband, smiled knowingly as he stood behind her.

Dr. Anderson sat down beside him on the bed and took his wrist to feel his pulse. "How are you feeling, Jimmy? You must be awfully tired after all you've been through today? Do you remember anything new?"

"New?" Jimmy said. "I remember it all. Every bit of it. Especially the last few months. That was a hell of a place to put a man my age, you know."

"Yes, I know. Most of our patients feel the same way once they recover themselves. But the main thing is that you remember and that you are all right."

Then, from behind the adults, a small, quavering voice piped up.

"Do you remember me, Jimmy?"

George and Anna stepped aside. Between them stood Kathy, her long, straw-blonde hair blown across her cheeks.

And then the last of the hidden, secret thoughts of the aging man that had been James Lockwood revealed itself. The image that he had carried with him from the earliest moments after leaving the hospital resolved itself with startling clarity. The most beautiful woman he had ever seen. . . .

But it had not been his mother. It had been his wife!

And he was angry with her not because she had died, but because she had gone on before him, taking the treatment and leaving him behind alone.

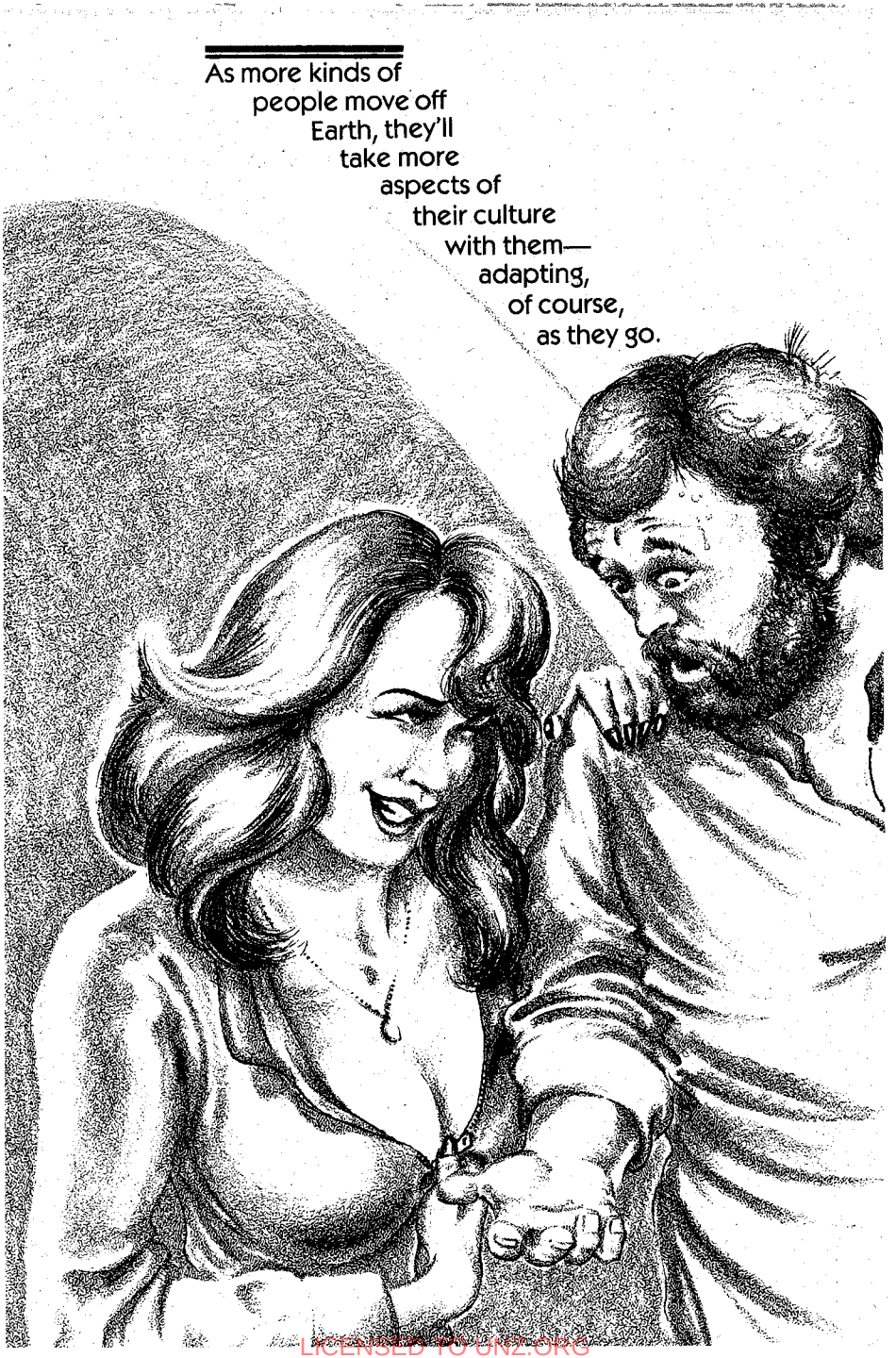
He opened his arms, as the tears ran down his face.

"Katherine, my darling, how could I forget the most beautiful woman I have ever seen?" ■

●The ordinary 'horseless carriage' is at present a luxury for the wealthy; and although its price will probably fall in the future, it will never, of course, come into as common use as the bicycle.

The Literary Digest, October 14, 1899

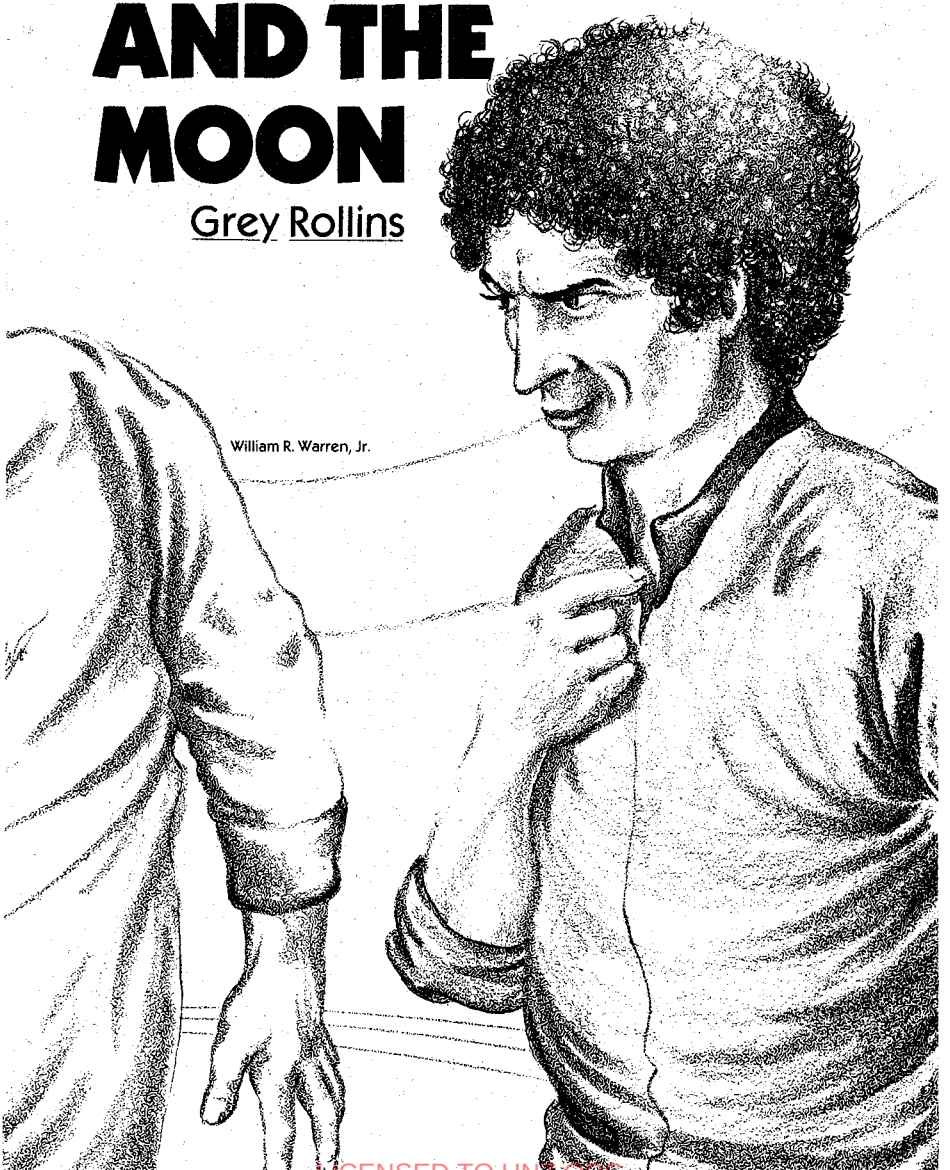
LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

MAGNOLIAS, MINT JULEPS, AND THE MOON

Grey Rollins



LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

So small!

Desiree Stuart-Gwaltney had trouble believing how little the port at Crisium really was. Why, people spoke in the same breath of Crisium and cities like New York, Tokyo, and London. She had expected to see more than just a large pit in the ground where the shuttles were berthed.

She walked carefully through the interconnecting tube from the orbital shuttle *Pegasus* to level three of the underground terminal that served Crisium. The sectile tube bounced and swayed from the weight of the passengers. Desiree experienced a quick flash of the same fear that she had felt the first time she had been in a jet that had flown through turbulence. The alarming way that the wings flexed as the plane rode through the pockets of rough air had nearly scared her senseless.

She had been warned that Lunar gravity was tricky. Indeed, it was hard to forget. Too much energy in her walk tended to leave her floating in air for a discomfiting moment after each step. Wade would, no doubt, have teased her about being light-headed or some such.

Of course, what Wade might have thought or said no longer mattered.

Relying on her lessons in poise as a child, and walking as though she were carrying a book on her head, Desiree managed to walk quite well in the low gravity. Much better, in fact, than the average ground hog.

Ground hog! She grimaced at the term. Imagine being compared to such a silly little animal. She remembered seeing them waddling by the roadside, especially on the Blue Ridge Parkway when she used to drive up from Atlanta for a weekend in the mountains.

Oh well, it could be worse.

She collected her suitcase from the carousel and made her way towards the customs area. Making a conscious effort to so that each step had a little gliding motion to it, she slid up to the counter.

"Anything to declare, miss?" the man in the gray jumpsuit asked.

"Lord, no. By this point, you'd think I'd broken a law or something. Every time I get on or off a ship, someone asks me if I'm carrying anything more dangerous than a ball point pen," she told him.

The man replied, "I'm sure of that, but I'll have to check anyway."

"Well, be my guest. Everyone else between Atlanta and here has seen my bras and panties, I don't see why you shouldn't."

Grinning a very nonprofessional grin as he eyed her voluptuous figure, he said, "Uh, miss, I'm certain that it won't be necessary for you to take your clothes off. . . ."

Suddenly, realizing his meaning, she blurted, "I didn't mean it *that* way. It's just that everybody seems to want to see what I've got."

Hearing a snicker from the line of people behind her, Desiree subsided, blushing furiously. The customs officer tactfully ignored her while she regained her composure.

Zipping her bag closed, he pushed it across to her. "I hope you'll enjoy your stay here in Crisium. If you don't, come back and find me and I'll see what I can do to make it more pleasurable."

Desiree smiled politely, but did not

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

say anything as she was still a bit flustered. *That* conversation had certainly gotten out of control quickly. She would have to remember to think before she spoke. It was fine to tease a man if she intended to do so, but to have the conversation take such a bent when she was not prepared was disconcerting.

She took her bag and walked through the main concourse to catch a slideway into the city. Back on Earth, the amount of weight she was carrying had been quite cumbersome; here it was merely bulky.

The thought of the weight difference gave her a moment of brief satisfaction. On Earth, she had weighed just under 135 pounds. Not too heavy for a girl who stood five feet, nine and one half inches in her stocking feet, but she had always wanted to loose three or four more pounds. The idea of weighing 130 pounds had always had a certain magic about it. Now, she suddenly weighed 22 pounds.

Take *that,* Claudia Honeysucker!

Of course, here they insisted on using metric terms, which meant that she weighed a little over ten kilograms. Somehow, that did not have nearly as satisfactory a ring to it as twenty-two pounds.

There was a You Are Here map at the mouth of the corridor that led from the port into the city proper, so she was able to discover the way to the Hilton quite easily. It was only a little distance. She decided to walk instead of riding the slideway again.

The slowest lane of the slideway from the terminal to the city had proved no trouble—no more to it than riding an escalator—but she knew better than to press her luck. The intricate little steps that people took skipping to and from the higher speed lanes looked like the kind of thing that would take practice. Certainly not something that she would want to attempt for the first time while carrying luggage.

She checked in without difficulty and made her way to her room. Small. Much smaller than she had expected. The bathroom was only a partitioned stall less than the size of a dinner table. Worse yet, there was no bathtub—only a shower. She had been looking forward to soaking in a hot bath after spending the past few days cramped into a shuttle seat the size of a paperback book.

She removed her clothes and checked herself with a critical eye in the full-length mirror on the side of the bathroom stall. Not too bad. The enforced inactivity on the shuttle had made her worry that she might have gained an objectionable amount of weight.

Zelda Simmons had taken her aside before she had left Earth and warned her about some of the changes she should expect when she got to Luna. The worst one was that she would lose all the roundness that made her derriere so cute. There simply was not enough gravity. Those muscles were there for walking, but in the lower lunar gravity they would simply waste away. Between them, they had worked out an exercise regimen that she hoped would maintain the proper shape. Men could be counted on to notice such details.

On the other hand, her breasts would loft better without Mother Earth's gravity dragging them down, so it was a trade off. Give some, get some.

She took a shower, noting with

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

amusement how slowly the water flowed down her body. Everything looked as though it were happening in slow motion. When she got out of the shower, she picked up her bra, stretched the elastic, and shot it across the room. Laughing, she skipped over and picked it up from the floor. Hardly aerodynamic, it had zipped all the way across the room. At home, it always arced to the floor well before it got to the laundry basket, no matter how she tried.

She sat on the edge of the bed, intending only to test the mattress. However, the seductive feel of the soft synthetic covers coaxed her into lying back. It was easy to pretend that she was a cloud floating effortlessly through the air. Her reduced weight made the bed so soft. . . .

Desiree awoke the next morning feeling more than a little disoriented. The covers were too light across her thighs. It was too quiet. Even the air itself smelled different.

It took a moment for her to adjust to her surroundings and remember where she was. Then she laughed aloud. To think that she had sat on a low hill just after her eighth birthday and wondered what the name of the man in the Moon might be—now she was the woman in the Moon.

At least *a* woman in the Moon. The fact that 37 percent of the current population of Luna was female didn't deter her at all. The obvious corollary was that the remaining 63 percent were male. Truth be known, it was one of the main reasons she had come here. That and the chance to escape Claudia Honeysucker's triumphant smirk as she had waltzed off with Wade Dobbins, Desiree's fiancé.

Sitting up and swinging her legs over the edge of the bed, she found them pivoting around further than she had planned. The resulting torque threw her face down on the edge of the mattress.

Remembering to move with a little less than her accustomed vigor, she set about making herself presentable. It was unfortunate that jumpsuits were *de rigueur* on Luna. She had never looked her best in a jumpsuit, although she had managed to find one in a shade of green that set off her auburn hair perfectly. Oh well, when in Rome, be a Roman candle.

"We've got a new girl coming to work today," Ron Carson remarked to his subordinate.

"Girl . . . as in female?" Jay Williams inquired hopefully.

Carson nodded agreeably. "Head to toe. Guaranteed to carry only the finest of XX chromosomes."

"It's about time. Maybe I can get a date with her."

Carson chuckled at Williams's optimistic demeanor. "One thing's for certain. You won't have any competition from Sammy."

"Be thankful for small favors, right?" Williams observed. "What's she like?"

"From what I hear, she's a daddy's girl—never had to deal with the real world. Her father owns one of the biggest banks in Atlanta. Clout is his middle name, so I would be very careful not to piss off his darling baby girl, if I were you. You just might find yourself breathing vacuum."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Williams snorted. "That kind, huh? What if she can't cut it?"

Carson shrugged. "We'll cross that bridge when we come to it. For the time being we're going to assume that she's a legitimate employee and an experienced saleswoman. My father apparently owed her father a favor and that's all there is to it."

"This has all the makings of a disaster," Williams moaned.

"Pessimist!" Carson replied, but he wasn't very hopeful himself. Hiring people blindly rarely worked out.

After studying the way other people's feet danced as they moved from one lane to the next on the slideway, Desiree summoned up her courage and hopped to the next lane. She nearly overbalanced. Her reflexes were still trying to get used to the difference between her mass and her weight. After wobbling for a second, she thought about it and executed a nearly perfect step back to the slower lane.

Thank goodness her mother had made her take those interminable dance lessons. She had hated them at the time, but they had taught her a body awareness that she was finding useful now.

Somewhat more confidently, Desiree skipped back to the second lane, then to the third. Content with this small success, she restrained the temptation to go all the way to the inner, fifth, lane. There seemed to be a larger speed differential between the successively faster lanes.

"Well done," came a masculine voice at her elbow.

Startled, Desiree jumped and nearly lost her balance.

The stranger caught her by the shoulders and held on long enough to make sure that she was under control again. "I apologize. I didn't mean to scare you."

Flashing him a quick, guilty smile, she said, "I'm sorry, I didn't think that anyone was that close to me or I wouldn't have tried to change lanes. I didn't want to hurt anyone if I fell."

The man laughed easily. "Oh, I was far enough behind you when you started, but I stepped over onto the faster lanes to catch up with you. I thought you might need help, but I can see that you obviously have a natural talent for this kind of thing."

She shrugged. "Nothing to it as long as you don't try to move too quickly." Glancing up, she saw the exit sign that she had been watching for go past. "Oops! Excuse me, I've got to get off."

As she turned to speak to him, her right foot inadvertently strayed over onto the slower lane. The speed difference spun her about and threw her onto the slower lane.

Instantly, the stranger was by her side. "Are you hurt?"

"Only my pride . . . and I'm afraid that I've gotten my jumpsuit dirty, too." Fuming at herself, Desiree got off of the slideway and walked back to her exit. It was only a minute before she was standing before the entrance to Carson Clothiers, currently the only clothing importer on Luna.

The receptionist looked up from the computer terminal where he was working. "Good morning. What can I do for you?"

"My name is Desiree Stuart-Gwalt-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

ney. I'm supposed to start work this morning."

"Oh, yes. I was told to expect you. Have a seat and I'll let Mister Carson know that you're here."

Ron Carson came for her before she even had time to sit down. "Desiree, how are you? My father told me that you would be arriving yesterday, but I didn't expect to see you until you had gotten settled in."

"It doesn't take long to unpack one bag. Perhaps after I find a house. . . excuse me, tunnel, I'll send for the moving vans."

Carson laughed. "That would be a sight to see. Come with me. Let's get you acquainted." He skidded to a stop before rounding the corner and gestured back at the receptionist. "That's Tony, in case he didn't introduce himself."

Carson led her down a short hall past three other offices. The first one belonged to Sammy Nichols. Broad, well-muscled shoulders hinted at a background playing college football and truly fierce workouts with weights now that he was on Luna. As he looked up, he ignited a smile that would have broken the heart of any practicing orthodontist. Perfect teeth gleamed at her.

The next office, diagonally across the hall, was empty. Carson told her that it would be her office.

The third office belonged to Jay Williams. Desiree immediately pegged him as a wolf. His eye took her in within milliseconds of her appearance in his door. His smile, though not nearly as perfect as Sammy's, was even more glaring—he tried considerably harder.

Leaping up from behind his desk, he slipped around the side and shook her hand warmly. "Glad to meet you! I hope that if you have any problems you'll feel free to come to me. I'll be glad to help you in any way I can."

Carson cut him short and led her into his office at the end of the hall. He closed the door, a conventional one on hinges. "Have a seat. Should I call you Desiree, Miss Stuart-Gwaltney, or Miss Gwaltney? I'm afraid I'm not totally sure what the current usage is on Earth. I seem to recall hearing that Ms. went out of style again a few years ago, but for all I know it may be back in again."

"Oh, heavens, just call me Desiree. I use Miss Stuart-Gwaltney when I'm being formal, but it's a bit cumbersome for day-to-day use."

He grinned at her. "OK, Desiree it is. Call me Ron. Everyone else around here does, at least when they're not calling me something uncouth." He seated himself behind his desk. "Would you like the standard orientation lecture?"

"By all means."

"OK, let me see if I can remember how this goes." He leaned back in his chair, put his feet on his desk and stared at the plastic ceiling as though it helped him to concentrate. "We import and sell clothing. All kinds, all makes, all sizes. By and large, that translates into jumpsuits, underwear, and the little slippers that you've seen everybody wearing. We also sell a separate line of accessories for vacuum suits. For that matter, we sell the vacuum suits themselves, but since they're expensive we don't sell too many." He glanced over at her. "How am I doing so far?"

"Uh, fine, I suppose. I've never heard your spiel before, so I wouldn't know if you left out a line or two."

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Now, that's what I like—an appreciative audience." He thumped his feet to the floor. "What the hell, it's a boring lecture anyway. I've grown tired of it, myself."

"Do you make the clothing?" she asked.

"A little of it. A lot of the fabrics have to be grown or manufactured on Earth. The unions managed to slip in a clause that reads something to the effect that 80 percent of the fabric that gets shipped up here has to be in the form of finished articles of clothing. That works both for and against us. In the long run it's just going to force us to become self-sufficient that much more quickly, as there's no point in paying union wages to someone on Earth when we can create a whole slew of jobs up here by doing it all ourselves. That will take time, though. Right now self-sufficiency in food has higher priority than clothing."

Desiree frowned. "Clothing is pretty important."

Carson laughed. "Only if you don't have any. Actually, we could keep it warm enough in the city that you wouldn't need clothing."

She smiled coquettishly. "I'm sure you wouldn't mind that at all."

He grinned back at her. "It might have advantages, at that. On the other hand, you and I would be out of jobs overnight. That might be a bit of a nuisance."

"There's something I've been meaning to ask you. Why does everybody wear jumpsuits? I mean, isn't there anything like a fashion market here on Luna?"

Carson shook his head. "Not really. Jumpsuits are cheap, practical, and easy to care for, but that in itself wouldn't be enough to make everyone wear them. The bottom line is that wearing one just might save your life."

Desiree's eyes opened wide. "Come again?"

"If we are ever unfortunate enough to suffer a massive blowout, there are only two options for survival. One is to be inside a tunnel equipped with a safety portal—one that automatically seals in the event of decompression. The other is to be able to get into a vacuum suit before you lose consciousness. For men it wouldn't be too great a problem—pants would fit into the suit legs well enough to get by. But some of the fashions that women wear, at least on Earth, would be nearly impossible to stuff into a suit before unconsciousness set in."

"Oh. How long do you have?"

"It varies from individual to individual. Physical condition is one of the variables, but there are other factors as well. If you go to complete vacuum instantaneously you'll lose consciousness in less than twenty seconds, but it's more likely that it will take a certain amount of time for the air pressure to drop. Don't count on having more than about a minute or two."

Desiree's brows knit. "That's not too bad. I can get a lot done with a skirt in that amount of time. In fact, I once . . . well, never mind, but I'll bet I could get into a suit inside of two minutes."

"With your nose and ears bleeding? Your vision will blur because your eyeballs will distort due to the drop in pressure. And don't forget that it would be highly unlikely that you would be stand-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

ing right next to your suit when the air suddenly went away. No matter how careful you are, you have to assume that your suit will be at least one room away."

"But—" she began.

He held up his hand. "One last thing and I'll let you have you have your say. If the blowout was really bad the air would be moving in excess of, say, one hundred miles an hour. If that takes you towards your suit, fine, but the chances are that you will be having to go against it, or at least across. Have you ever tried to stand up in a gale?"

Desiree sat silently for a moment. "Oh."

"Sorry, but that's the way it is. That's why we sell jumpsuits."

She made one last try. "What about the people in the corridors, Ron? They won't be able to get to suits."

"No," he admitted. "There are pressure doors that would close and contain the air loss, but we would almost certainly lose some citizens. We've tried to think of a way around the problem, but nothing seems practical."

"But, Ron, that's awful."

"I know."

Desiree's eyes narrowed. "There ought to be a way around that. Let me think on it a bit."

Carson didn't bother pointing out that the best minds available had failed to come up with a workable system. He just sighed.

Desiree and Carson made a short trip across town to an account that he intended to put under her care. They could be counted on for a fairly steady flow of orders even if she turned out not to have a knack for selling. A few accounts like that and she wouldn't starve, no matter how bad a saleswoman she might be.

He watched her carefully to see how she handled herself. He need not have worried. Desiree was very attractive, but when she turned on her charm she was irresistible.

Sales being 90 percent the ability to relate to people, Carson made a snap-decision and took her to another account. One more difficult to handle.

He stopped her outside the portal to the store. "I want to warn you about the man who runs this place. His name is Jack Hiers. The store has done well and he is fairly wealthy by Lunar standards. That, combined with the fact that he's young and good-looking has made him something of a womanizer. As much of one as you will find in Crisium, anyway."

Desiree cocked her head and looked at him sideways. "Why, Ron," she said, allowing her Southern accent to roll over him in waves, "surely you aren't worried about me being able to handle a *man*, are you?" Placing her hand on his chest, she peered up at him, eyes wide and innocent.

Suddenly feeling the sexual temperature rise, Carson wished he had a collar to loosen. "Uh . . . no. As a matter of fact, I was just about to suggest that you hit him with some of your good old Southern charm."

Carson led the way past the displays to an office in the back of the store, where he knocked lightly. There was a short pause.

The door opened, revealing a man over six feet tall. "Why, hello, Ron!"

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

he boomed in a bass voice that shook the walls. "What an unexpected pleasure!" He eyes latched on to Desiree the way a man in the desert might grab for a canteen full of water. "And who have we *here?*"

Carson turned to introduce Desiree. "Jack, this is our new . . ." His words faltered. His mind panicked. While his back had been turned, Desiree had lowered the zipper on her jumpsuit by a handsbreadth, exposing a substantial amount of cleavage.

Desiree smoothly filled in the awkward silence. "I'm Desiree Stuart-Gwaltney," she breathed, extending her hand.

Jack Hiers bent low and kissed her hand. "Glad to meet you," he said, his eyes glazed.

Carson recovered. "Uh, as I was saying, Desiree will be your new account executive. From now on, if you need anything, don't hesitate to ask her for it."

"Dinner perhaps?" Hiers asked her. His voice was at least a half octave lower than it had been when he first opened the door. If it deepened any more it would be below the limits of human hearing.

"Oh, I'm really terribly sorry, Mister Hiers, but I just got in on the shuttle yesterday and I really ought to be in bed . . . sleeping." She sighed and Carson half expected her to fan her face as though she might collapse at any moment. "You know how tiring those shuttle flights are."

"Please, call me Jack."

Carson tried to get the conversation back on track, but the effort was in vain. Hiers was oblivious to his presence. After exchanging pleasantries for a few more minutes, Desiree wrapped up the conversation on her own. "As Ron was saying, please don't hesitate to call me if there's anything I can do for you. Anything at all."

Hiers nearly broke into a sweat. "Any time you're in the area, please feel free to drop in and see me."

Just as Carson and Desiree turned to go, a man came up and began to speak to Hiers. "Jack, would you mind looking over these reports, I think there's something . . ." His eyes fastened onto Desiree. "Uh, actually, I think I can take care of it myself."

"Good-bye, Jack. See you soon," Desiree drawled in her most ingratiating Southern belle manner. She turned and walked away, putting slightly more voltage than necessary into her walk. Carson scuttled to keep up. Behind them, they could clearly hear the two men talking.

"I just love women from the South," Hiers said.

"Yeah, the deep South," replied the other.

Hiers chuckled slyly. "I'd like to take a swim in *her* depths, that's for sure."

Desiree turned on her heel and winked back at Hiers. "Trust me, darling . . . you'd drown." She smiled at him saucily and undulated away.

Once back out on the slideway, Desiree slid her zipper back to a more discreet position. Beside her, Carson fumed.

"What's wrong, Ron?"

"If you keep acting like that, you're going to make a mess of things."

"What do you mean?"

"He's going to start thinking pleasure

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

before business, instead of vice versa. That's not going to work."

"Want to bet?" she asked, grinning.

"*Bet?* This isn't some game, Desiree, this is real life!" he bellowed.

"How big is Jack's account?"

Carson shrugged angrily. "At this point? About average, maybe a little bit above. It's a good account, but hardly one that will make you rich."

"I'm willing to bet you a paycheck that within a year, I'll have his store among our top ten accounts. And," she added significantly, "I'll do it without ever going any further with him than you just saw. He'll push the stuff I sell him just to keep me coming around, whether he ever gets anywhere with me or not."

"I don't believe it," Carson groused.

"Do you take the bet?" Desiree persisted.

"All right, I'll take your bet. I'll even go so far as to double my end of it."

"Done," she said solemnly.

As they walked back into Carson's office, Jay Williams leaned around the corner. "Strangest thing just happened. You know how Hiers always puts in his orders the last week of the month?"

Carson pursed his mouth, tasting alum. "Yeah, so?"

"He just called in a huge order and today's only the eighteenth."

Carson said nothing after Williams ducked back around the corner into his office.

Desiree just smiled.

Two months had passed. Desiree now had a tunnel of her own. Her job was going well, but she felt as though she might as well be selling hammers and nails as articles of clothing. Carson Clothiers, at this point the sole arbiter of sartorial taste, was dominated by men from top to bottom and their ideas of what constituted proper attire were unimaginative at best. She could count on one hand the number of times that she had seen women wearing something frilly and frivolous. Her efforts to introduce something gloriously impractical might as well be equated with swimming in chocolate syrup. High in caloric content, but low in actual progress. Ron wasn't actually against the idea, he just didn't think that it would sell enough to make it worthwhile. He preferred to stick to his tried and true formula of jumpsuits, jumpsuits, and more jumpsuits.

Slumped in her tub—she had insisted on getting a tunnel with a tub—she tried futilely to shake off a growing depression. Her love life was moribund. Her ex-fiancé's face floated in her dreams, alternating with the infuriating, mocking smile on Claudia Honeysucker's lips the last time she had seen her.

Oh, there were men enough to drown in. All sorts and kinds. She could have had a dozen lovers if she had the time and the stamina to keep up with them all. The trouble was that, like the ubiquitous jumpsuits, they were all relentlessly practical. No fire, no romance, no spark.

Her mind said give up, admit defeat, and go home. Her pride refused to even consider the notion. There was no power in the known universe that could make her face Claudia Honeysucker with Wade's ring on her finger and his last name tacked on the end of her own like

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

some ill-gotten spoils of an undeclared war.

She splashed the suds, watching the slow motion ballet as the drops and bubbles tumbled in the air. That was another fact to be considered. Her body had already begun to acclimate to the lower gravity. There would be hell to pay if she went back to Georgia. She would develop aches and pains beyond her imagining as her body coped with the full crushing embrace of Mother Earth. Besides, if the truth were told, she rather enjoyed the chance to dance lightly across the slideway lanes. The pure joy of the movement was its own *raison d'etre.*

She took her cues from the children. They were the first generation to grow up in anything other than one full Earth gravity. Their whole style of locomotion was subtly different from their parents'. More fluid and relaxed. Whenever Desiree saw a child, she consciously tried to emulate the dainty, almost tiptoe way that the feet moved. It took work, but it could be done.

There was something else about the native children that had taken her quite some time to notice. They were unafraid on some deep, primal level. Falling on Luna was not the trauma that it was on Earth. The human body had evolved to withstand far more punishment than it received on Luna. She had even heard a psychologist wonder aloud whether fear of falling was truly instinctive or if it was learned. Such an idea would have been regarded as heresy without the opportunity to observe Lunar children as they tumbled to the floor with total abandon.

The thought of children led inevitably to her desire to have a family. That, in turn, led to the sour fact that she had no man in her life who was even a remote candidate for marriage.

She laughed bitterly, sending slow ripples through the water. Sammy Nichols had been a total disappointment. She had watched him with interest for the first few days before realizing that he, like so many other men on Luna, had come to terms with the lack of available women by readjusting his sexual orientation. He was gay; what her father would have derisively referred to as a 'heshe.'

That had been one of the unpleasant little surprises that the cold statistics had concealed from her. Sure, there were two men for every woman on Luna . . . numerically. But in reality, a great many of them were gay. Such a waste!

Viewed dispassionately, Desiree could understand that such an adjustment in lifestyles might seem desirable, even necessary under the circumstances, but it didn't mean that she had to like it.

Carson had laughed at her when she had stormed into his office, frustrated by the realization that Nichols was gay.

"Water, water, everywhere, and not a drop to drink . . . ." he teased her.

"But *why?*"

"Because, like it or not, it's mostly men who are coming to Luna. There just aren't enough women to maintain the social norms that you're accustomed to. Men, at least at this stage in history, are more aggressive and more likely to take risks, such as living in a hostile environment. If we were in the middle of one of the resurgent waves of women's liberationitis, I imagine that there might well be two women for every man." He

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

stared thoughtfully at the ceiling. "Of course, then there would be a high incidence of lesbianism . . ."

Desiree threw a clipboard at him and flounced out of the room. After a while she had gone back to apologize—for throwing the clipboard at him—not for his insensitive comments.

He had laughed it off. "Facts are facts, Desiree. Ranting at them . . . or at me, won't change them."

"But they *aren't* facts, Ron! They're just your . . . your . . ." she paused to control herself, feeling her temper and frustration rising to the surface again.

"Opinions? Is that what you were going to say?" He smiled sadly. "When was the last time you went out on the surface?"

She frowned, confused at what she regarded as a change in topic. "I've never been out on the surface. Why would I want to go out there?"

He had shrugged, palms up. "I rest my case. I know men who go out on the surface just for the fun of it. To be honest, I know one woman who does, but only one."

"What's that got to do with it?" she demanded.

He shifted the topic again slightly. "Did you ever go camping on Earth?"

Beginning to sense his point, she replied, "No."

"Did you know any men who camped?"

She nodded.

Almost apologetically, he said, "These things are largely cultural, Desiree. There was no reason for you not to go camping on Earth, just as there's no reason for you not to go out on the surface here, but the fact of the matter is that we live in more *macho* times than that. Right now women are protected—what they used to call being put on a pedestal. In ten years, it will probably all flip again and women will be wanting equality. Speaking personally, I don't mind either position. What I do mind are the transition periods when women want to have their cake and eat it too."

"Do you really believe that women are that wishy-washy?" she demanded angrily.

He shook his head. "No, Desiree, you're not listening to what I'm saying. I think that our *culture* is that wishy-washy. We are simply pawns of our times. Trying to go against the currents of your culture can be done, but it's risky."

"You make it sound as though women can't hold their own! I'm producing more than any of your sales*men*. Look at my sales figures!"

He sighed. "But you do it by using *your* figure—" He held up a hand to forestall her comment. "There's nothing wrong with that. Sex has been used to sell things since time immemorial."

She sat silently, trying to think of an appropriately scathing reply, but none came.

"Desiree, you're the best I've got and unless I miss my guess, you haven't even hit your stride yet, but take a good hard look at how you fit into the society that you live in."

"You don't think I would have done as well if things were more . . . equal, do you?"

"I honestly don't know, Desiree. What moths do with pheromones and elephants do with infrasound, you do simply by existing. You devastate men

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

just by walking into the room. Whether it's something you learned or whether you were born that way I would not care to speculate, but one thing is for certain."

"What's that?"

"You have enough intelligence and drive that I don't think I would ever bet against you."

"Thanks . . . I guess."

For two days she had thought about what he had said. She had even gone out to dinner with a man and behaved in as liberated and equal a way as she could manage. It had been a disaster.

By the end of the evening, bits and pieces of her normal personality were beginning to show through. The man thought that he was melting her reserve, when in actuality it was just her usual way of relating to men. She had had the devil's own time getting him to leave her alone once he had gotten started. Eventually, she had resorted to insulting him dreadfully to get him to quit pawing at her.

Hurt, angry, and confused, he had cut the evening short and escorted her back to her tunnel. She had sat in the dark for hours, thinking. The man hadn't deserved to be insulted. It had simply been a case of crossed wires; she had been trying to be something she wasn't. The problem was that she wasn't sure that she liked what she was any more.

For the next few days she noticed that people avoided her. Even the usually talkative Williams kept his distance. She derived a certain bitter satisfaction from the fact that she could repel men as well as attract them, but she knew that it wasn't in her best interests to alienate her friends and co-workers.

It made her uncomfortable not to know who she was.

Carson leaned in Desiree's office door. "Can I speak with you a moment?"

She suppressed irritation at the interruption and followed him into his office. He sat behind his desk and regarded her steadily for a moment. "Have a seat," he suggested, gesturing at a chair.

Biting her lip, she sat. "Is something wrong?"

He chuckled mirthlessly. "I was going to ask you that."

Confused, she said, "I'm not sure that I follow you."

"For the last week you've been, shall we say, difficult to get along with. I was just curious if there was something wrong."

She thought carefully for a moment. "It's a personal problem. Nothing you need to worry about."

"Desiree, whatever is wrong is severe enough that it's beginning to affect other people. Specifically those that you work with here. That makes it my business."

"Ron, I . . ." she faltered, embarrassed. "After we talked the other day I started thinking. You said something about thinking about where I fit in. Well, I'm not sure that I do."

He nodded thoughtfully, "I had noticed that you weren't acting like your usual steamy self."

"But that's just it. I'm not sure that I want people to see me that way, Ron."

"Is that all? I get the feeling that there might be something else bothering you."

Desiree took a deep breath and let it out very slowly before responding.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"I'm lonely," she said in such a small voice that Carson had difficulty hearing her.

"No boyfriends?"

She nodded, not trusting herself to speak. Tears were not far away and she wasn't about to let him see her cry.

"Let me add two and two and see what I come up with, then you can tell me if I'm wrong. OK?" She made no reply so he continued, "You attract men the way that static attracts dust. The problem is that the men you've been attracting aren't what you had in mind . . . less than the dust beneath your feet, so to speak. So, in order to keep from having to deal with the riff-raff, and because of our conversation, you tried to turn off your sexuality. That in turn led to a conflict with your basic personality, so now you find that you're at war with yourself." He peered at her closely. "How am I doing?"

"Bingo," she whispered.

"My advice, and, yes, I know you didn't ask for it, is to be yourself. You can handle men. I've watched you do it. Just carry on as though nothing were wrong. It's difficult sometimes to keep your chin up, but you can do it. You've barely gotten settled in here. Sooner or later, someone will show up who will make Wade seem like a bad dream."

Her eyes darted to meet his. "*Damn* you!" she hissed. "How did you know about Wade?"

Carson inspected an immaculate fingernail. "I got in touch with your father to see if he could shed some light on this situation."

"I'll *kill* him!"

Carson shook his head. "Not necessary, my dear. Your secret heartbreak shall remain hidden."

"But—"

He raised his hand. "Just take it easy and try to get your life on track. If you need someone to talk to, I'm available. I don't claim to have the answers to all problems, but I do have an absorbent shoulder if you need one to cry on."

She started to say something, but thought better of it. After a moment she said simply, "Thanks, Ron, I may just take you up on that sometime."

Desiree was just getting off of the slideway that evening when the klaxons began to wail. Alarmed, Desiree looked around her.

People were scattering, running as fast as they could towards the nearest tunnels. A woman passed her, skidded to a stop, reached back and grabbed Desiree's arm. "Get into a tunnel, you idiot! We're losing pressure!"

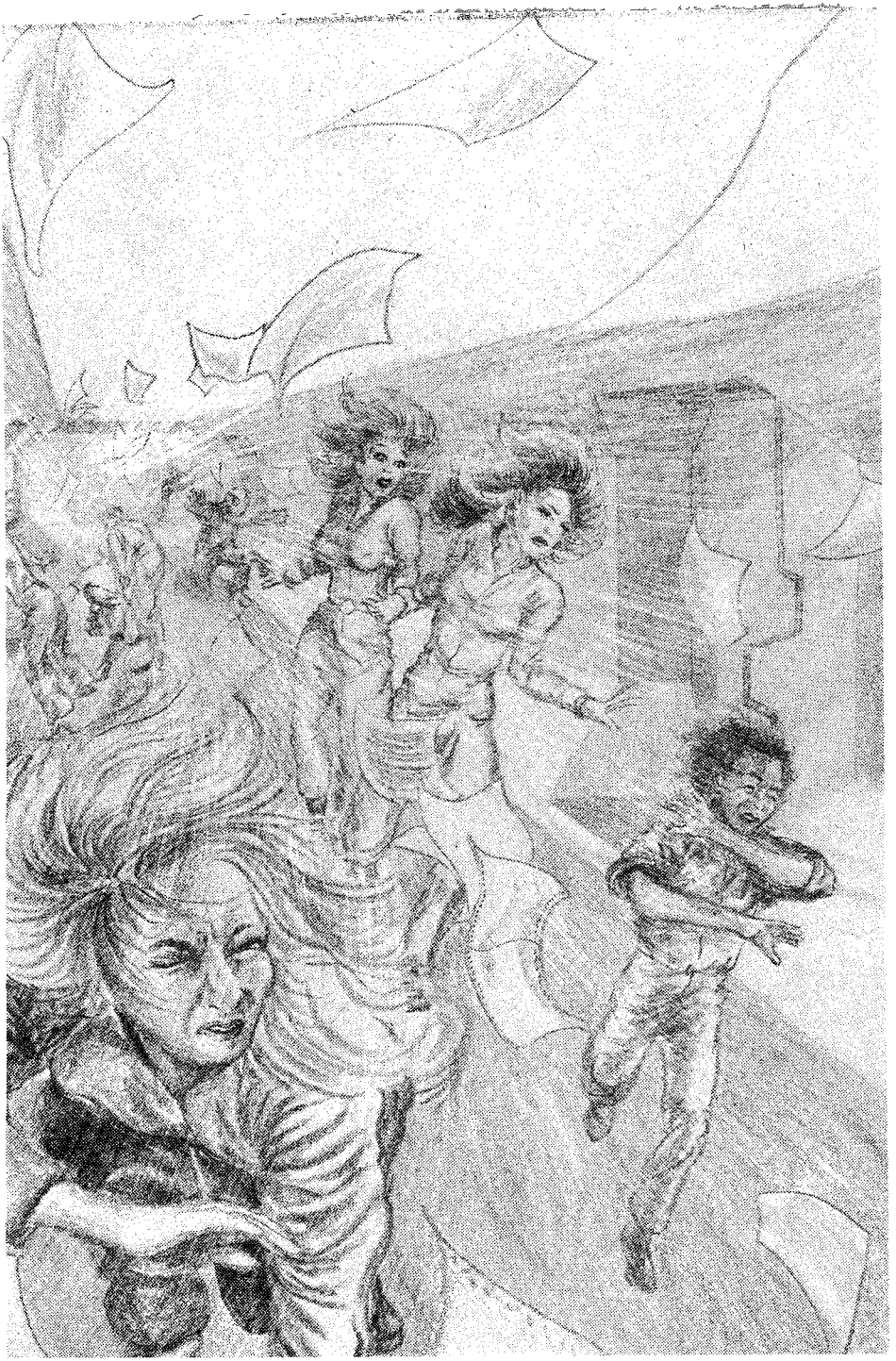
Desiree finally came to life, pointing ahead. "This way! My tunnel's down here. . . ."

The woman nodded and followed. They ran into the mouth of the side corridor leading to Desiree's tunnel just as the pressure door began to grind shut. Stopping just inside, they pulled a small child through just before it closed.

"Let's get into your tunnel. The more doors between us and vacuum, the better."

Desiree nodded and led the way at a fast walk. She slapped the palm lock and was gratified to find that it opened. The corridor had lost enough air pressure so that some of the air in her tunnel whooshed out around them when the portal opened.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED



LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Once the three of them were inside, she closed the portal and manually triggered the seals. "Are you two all right?"

The child was taking the situation more calmly than either of the adults. "Oh, sure. I remember the last time this happened. It was a lot worse than this."

Desiree turned to the woman. "Just exactly how often does this happen, anyway?"

"This is the second time since I've lived here. That's about four years now."

The child, a little girl, nodded. "Two years ago. It was May thirtieth."

Desiree was shocked to find the girl taking it so matter of factly. "Was anyone hurt?"

She shrugged a little girl shrug, her shoulders nearly touching her ears. "They said two people died."

"But—"

"Don't worry about it. They'll have it fixed in an hour or two and we can go home. Can I have a drink of water?"

Desiree walked to the kitchenette in a daze. When she turned to the sink to fill the glass, she found that the pressure surge when she had opened the portal had caused the sink to back up. She filled the glass and returned to give it to the little girl. "What do we do now?"

The woman spoke up. "You still have power. Turn on the news. They'll let us know when it's safe."

"What channel?"

The woman and the girl both gave her pitying looks. "It'll be on *all* the channels, silly," the girl said finally.

It was only about an hour until they announced that it was safe again. Thanks to the emergency pressure doors, only a comparatively small area of the first level had dropped all the way to hard vacuum. No one had been seriously hurt.

Desiree and her two visitors had watched the news silently while a newsman in a vacuum suit had taken a camera to the site of the blowout. The emergency crew had long since filled the door-sized hole with sheets of rigid plastic and foaming sealant. They were already hard at work making permanent repairs.

Then the newsman had gone to the hospital to try to interview the man responsible for the blowout, but was unable to get permission to talk to him. His lawyer was standing guard outside his room.

According to what the newsman was able to learn, the man had violated the ruling that all powered ground vehicles must remain at least ten meters from any surface structure belonging to the city. He had been off-loading materials brought in from a remote work site and had decided to park next to the actual portal at East Lock. In a manner yet to be explained, he had lost control of his vehicle and rammed the wall, causing the blowout.

There was talk of criminal negligence charges being filed, possibly worse.

It wasn't until after the woman and the little girl had left that Desiree realized that she hadn't gotten their names. Disappointed in herself for her lack of even the most elementary social graces, she turned to the task of cleaning up her tunnel.

Surveying even the modest mess made by a comparatively small blow-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

out, Desiree was glad that she had not actually been present for a major one. Mostly it was simply loose paper that had been blown around the tunnel by the sudden gust of air as her tunnel had equalized pressure with the corridor outside, but the area near the sink was disgusting.

When the sink had blown back, it had spewed greasy, noxious water all over the counter and floor. Hair and bits of food floated in the water that still stood in the sink. There was also a plastic zipper bag floating daintily on the surface, as if afraid of being soiled by the filthy water.

The bag drew Desiree's attention. At first she couldn't figure out why. Of course the bag floated, it was air tight; just an ordinary zipper bag that she had left out that morning as she was preparing breakfast. Normally, she would have thrown the empty bag away, but she had been running late.

When she finally understood what made the bag so fascinating, she began to smile.

"You mean the stop valve on your sink didn't work? I'd have someone take a look at that right away."

Desiree took a deep breath. "Ron, you aren't getting the point. I don't care that the sink made such a mess—"

"You ought to. That could—"

"*Ron,* listen to me!"

His mouth shut with an audible sound.

"I'll get the damned sink fixed later, OK? What's important is that it gave me this idea. I want you to listen and tell me what you think."

It took him a few seconds to formulate a reply that would satisfy her. "OK."

She reached into her bag and pulled out some crude sketches. "Ignore the fact that I can't draw a straight line. What I want to do is this. . . ."

"Will you stop pacing, dammit!" Carson demanded.

"I will if you will," Desiree retorted.

Carson glanced down at his feet busily taking him the length of the small room and back again. "Uh, sure, right. Listen, Desiree, no matter how this goes, I want you to know that I'm still behind you, no matter what."

She stopped pacing long enough to take his face in her hands. "Ron, you're a dear, sweet man but you've already told me that three times in the last twenty minutes and I'm about to go out of my mind anyway. Please . . . do us both a favor and sit down. Then maybe I'll be able to calm down enough to sit down, too."

"I'm nervous," he muttered under his breath. "I've never done this before."

"And I have?"

He sighed and sat in a straight-backed chair placed against the wall, only to bounce up again to resume his frenetic traversal of the room. Desiree carefully pulled aside the tiniest edge of the improvised curtain and peeked out into the room beyond. She let the curtain fall back into place and nearly fell over Carson as she stepped back. He had been peering over her shoulder.

"For God's sake, Ron!" she whispered angrily. "Give me a heart attack next time!"

Chagrined, he backed away and sat

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

again. "I'm nervous," he said, checking his watch for the thousandth time.

"You said that," Desiree pointed out.

"Good evening, ladies and gentlemen," came a mellifluous male voice, muffled by the heavy curtains. "I would like to welcome you to the first showing of designer fashions here on Luna."

The applause started somewhat lightly, growing in intensity by the moment.

Desiree wrung her hands. "Thank God people here on Luna are willing to pull for the home team. Listen to them, Ron."

"Tonight we have a special treat for you. Not only do we have the privilege of hosting Luna's first showing of exclusive fashions, but I would like to make a somewhat more practical announcement. As of tonight, we here on Luna are a step closer to our goal of total self-sufficiency. The items that you will be seeing momentarily are articles of clothing that we are capable of making here on Luna, using materials produced here and, most importantly, using our own labor. Ladies and gentlemen, tonight you will witness the founding of a new Lunar industry!"

This time the applause started strongly and mounted into something so powerful that Desiree imagined that she could feel the stone walls move with the intensity of the sound.

"We here on Luna are free to pick and choose from the best that Earth has to offer as we build our new society. If we fail to find something that suits our needs, there is no shame in starting a new custom. One custom that I would like to start tonight is to present to you the originator of this beautiful, elegant clothing that we will see tonight . . . Miss Desiree Stuart-Gwaltney!"

Desiree closed her eyes momentarily as she gathered her courage. Nothing to it. Just pretend that it's like one of the dances she used to perform in front of a room full of politely bored parents when she was young.

Carson kissed her lightly on the cheek. "Go, girl, they're waiting for you. . . ."

The showing had been a fabulous success. Standing room only. The hastily converted shuttle hangar had been wall to wall with wildly approving buyers from every major retail outlet on Luna. The news media had been well represented. Luna had no fashion critics *per se*, but after tonight they would need a few—a small, necessary adjunct to the fledgling clothing industry.

By invitation only the cards had said, but gate crashers to the champagne party afterwards were gladly tolerated. Indeed, it had been an open secret that anyone who wanted to come would be welcome.

Desiree could see Sammy Nichols across the room talking animatedly with another man in a yellow jumpsuit who was there on behalf of the prestigious Adam Whittaker stores. She bit her lip and hoped that Sammy would be able to get a good order from him.

She could not locate Jay Williams at the moment, but when she had last seen him, he was talking to the buyer for the largest store in Besselton.

Finding Ron Carson was no problem. He had not been more than ten feet from her the whole evening. Without having to turn, she knew that he was looking

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

at her, his face beaming with pride. She was the star of the show tonight and he wanted everyone to know it. All evening he had been bringing excited faces over to meet her; an endless string of names that she had no hope of remembering tomorrow. She had finally relaxed, simply allowing her smile to radiate the happiness that she felt.

The past two minutes were the first time since the party began that she hadn't been either speaking or listening to someone, and she relished the comparative peace it afforded her.

"Excuse me, Miss Stuart-Gwaltney?"

Desiree allowed her smile to slide back into place as she turned to meet the new voice. "Yes?"

"My name is Edgar Rice. I'm with the Lunar Observer. If you wouldn't mind giving me a moment of your time, I'd like to ask you a few questions."

"By all means, Mister Rice. You ask anything you want. If I don't have an answer for you, I'll make one up."

He grinned. "Let's hope that it doesn't come to that." He adjusted the aim of the tiny gooseneck microphone that sprang from his collar so that it aimed more directly towards her. "Obviously, your designs were accepted very well indeed. What I would like to know is a bit more of the background. What led you to create these new outfits?"

"To be quite honest, I don't feel that I look my best in a jumpsuit. I wanted something more feminine, more . . ."

"Sexy?" he suggested.

"Well, yes, as a matter of fact. I come from the South—"

"Somehow your accent had sort of given me that idea," Rice teased her.

She laughed for the first time. Edgar Rice had a good honest, earthy feel about him. It was a relief to talk to someone who wasn't trying to fill her with flattery. "Now I wonder how such an idea could ever have crossed your li'l ol' mind," she responded, hamming for all she was worth. "Anyway, I wanted something that looked and *felt* better to me than a jumpsuit, but I was told by several people that skirts and such would interfere if I ever needed to get into a vacuum suit."

Rice nodded understanding. "Yes, it's an old problem."

"Well, I also thought that it might be nice to have something that could, in a pinch, hold enough air to give someone a little better chance to get to a suit."

"You didn't stress that very heavily during the show. Why not?"

"This was conceived primarily as a fashion show, not a display of utility clothing. I would rather that people viewed this as clothing . . . as fashion. The safety aspect is, and should be, secondary. With a little luck no one will ever need the safety features that were designed into the clothing."

"By you."

She nodded. "By me."

"Let me make sure I've got this straight. The fabric is a synthetic mesh that interlocks loosely. The way it works is that the fibers that make up the fabric are fashioned into little U-shaped channels as they come out of the spinnerets. These are knit into fabric so that they cup together. The upper edges of two adjacent U's fit together inside the cup of another so that they interlock. There's a tiny rib along the inside of each tip

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

that interlocks with the next one so that the fabric doesn't unravel. If the pressure drops, the fabric tightens up and all the interlocking fibers create an airtight seal."

"That's right. As long as the pressure is the same on both sides of the fabric, it breathes. That makes it more comfortable to wear."

Rice shook his head. "Ingenious. And in the collar there's a—"

"Hood, yes—nothing fancy. It's just a thin, flexible plastic hood with a plastic zipper seal on it that can fasten to the neck. And, of course, the slippers zip to the legs."

"But there's no air supply, right?"

Desiree frowned prettily. "At present, no. All I was hoping for was to give the wearer an extra minute or two. But that extra minute may mean the difference between being able to get into a real vacuum suit or not. We will be producing another version of this suit with an air nipple that can easily be connected to a small external air tank. That would give you up to ten minutes extra breathing time."

"Couldn't a jumpsuit be made out of this material?"

She nodded. "Of course. We intend to have a full line of clothing on the market within six months. For purely personal reasons, I wanted to go ahead with the fashion line first. Women here on Luna need an alternative to jumpsuits. There just aren't that many women who look good in them, no matter what color they are."

Rice gave her skin-tight outfit an appreciative head-to-toe appraisal. "I must say that your outfit certainly looks quite good on you."

"Then my goal has been achieved, Mister Rice. Have some more champagne. Mingle a bit. We can talk again later if you like, but I see a few people I need to spend some time with."

"By all means, Miss Stuart-Gwaltney. Oh, and by the way, best of luck with your Second Skin."

It was after four when Desiree, exhausted, tumbled into bed. She was asleep within seconds.

Just after nine, the computer chimed to let her know that there was an incoming call. Bleary-eyed, she reached over to the nightstand for the phone. She groped in vain for a few seconds before remembering that there was no phone, then cursed in a very unladylike manner. Sitting up in bed, she called out to the computer to answer the call with no video.

A man's voice came over the line. "Desiree? Is that you?"

Her blood suddenly froze in her veins. She would know that voice anytime, anywhere. "Wade?"

There was a maddening delay before he answered. "Yes, honey, it's me. I . . . I just wanted to know how you were doing up there."

The delay meant that he was still on Earth. "I'm fine, Wade, just fine. Doing quite well, as a matter of fact."

As she waited for his next words, her mind was carrying on a tormented consultation with her heart. The sound of his voice was balm to her soul, but surely he wasn't calling to try and patch up their relationship . . . was he?

"You know, I was just reading the paper here and I saw where you had a

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

fashion show last night. That *was* you, wasn't it?''

Her heart was hammering so loudly she could barely hear herself think. ''Yes, Wade.'' Gods above, what to do? Did she still love him, or was it just force of habit that made her want to tell him that she loved him?

''Listen, Desiree, I . . . well . . . I'd like to see you. I've missed you and there are some things that I'd like to talk to you about.''

Her mouth opened and spoke before her mind had a chance to think about what she was saying. ''What about Claudia, Wade? The last I heard, you were going to be married.''

One benefit to the slight pauses between his side of the conversation and hers—it allowed her time to think. Now if she would only use it instead of allowing her mouth to do her thinking for her.

''Well, you see, we *are* married. But it's not going too well and I . . .''

Her mind tuned out the rest of what he said in a great buzz of emotion. The fool thought that he could traipse off with Claudia and come back to her if it didn't work out? Why, that was unspeakable!

Her voice took on a commanding tone unlike anything Wade had ever heard from her. ''Does Claudia know you're calling me?''

Nearly three seconds later the hesitant reply came back. ''Not exactly, no.''

''Not exactly. I see.'' She paused for a second to marshal her thoughts. ''Wade, the last time I saw you, Claudia was on your arm. It was at Marjorie's Christmas party, remember? You didn't even have the decency to say hello to me, you bastard. Now you see my name in the paper and think that you can just call—wake me up too, mind you—and try to pick up where you left off? Well, guess what, Wade, it won't work. Go back to Claudia. You two deserve each other. You can both go to hell, for all I care! *Computer off!*''

After the computer broke the connection, in the middle of Wade's gasp, Desiree noted with bitter satisfaction, she slumped back down on her pillows. There was no doubt about it now. She had burned her bridges. There was no way she would ever go back to Georgia. There was no reason for her to want to.

Then why was she crying?

Carson had told her to take the day off, but she went by the office late in the afternoon anyway. Everybody looked as though they were hung over, but happy. So happy they could hardly count, as the line from the old song went.

''Desiree!'' It was Williams. ''We're doing great. *You're* doing great. I've had as many orders today—in just one day—as I've taken in the last two months combined. You're *splendo,* as the kids say.'' He kissed her gently, almost shyly. ''I'm proud of you. Go in and talk to Ron, you're all he's talked about all day. Maybe if you'll let him bask in your glory, he'll quit coming in and reminding me what a genius you are every five minutes.''

She smiled at him, but her heart wasn't in it. Hopefully, he would think she was just tired—that her eyes were bloodshot from lack of sleep. She knocked lightly at Carson's door.

''Come in. It's open.''

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

She pushed open the door and entered, suddenly reluctant to be here. "Hello, Ron."

"*Desiree!* I thought I told you to take the day off."

She nodded. "You did. Can I sit down?"

He sobered immediately. "Something's wrong, isn't it? Yes, by all means, sit down." He got up and closed the door quietly behind her. "Want to talk about it?"

"Remember when they burned Atlanta?"

"I can't exactly say that I was there at the time, but yes, I seem to recall that a certain General Sherman rather made a mess of things."

"Meet General Stuart-Gwaltney."

Carson understood immediately. He said only one word. "Wade."

She nodded. "He called this morning."

"And you told him to put it in his ear."

"Something like that."

"But part of you wishes that things had worked out differently."

"Something like that."

"And now your heart is in about six zillion pieces and if the devil offered you Wade, you'd trade all the clothing, all the adulation of the masses, all the money, just for one man."

"Something like that."

"My grandmother swallowed a phonograph needle, but it didn't affect me . . . didn't affect me . . . didn't affect me . . ."

Desiree managed to smile at the hoary old joke, but her heart wasn't in it. "Something like that," she repeated wryly, to let Carson know she had gotten his point.

"Is there anything I can do?"

"Shoot me?" she said hopefully.

He chuckled. "I don't think that's an option, Desiree. I had more in mind taking you to the mountain top and offering you the world."

She shrugged dejectedly. "Don't need it."

"How about something more mundane, like dinner?"

She looked down at her skin suit. "Um, are you sure that this is appropriate for dinner?"

"Desiree, you designed the clothing. You get the privilege of setting the precedents. Wear it wherever and whenever you want, my dear. You've earned the right."

She slowly looked up at him. "You're sure it's OK?"

"What's wrong? Got stage fright? Let's go scare the hell out of some little old granny."

Something that might have been a giggle escaped her. "I suppose you're right, now's as good a time as any. If I don't wear this stuff, no one else is going to."

Carson stopped on the verge of pointing out that she had worn it across town. "I think The Satin Dragon will do for starters."

She grasped. "But that's the most expensive place in town! I thought you had to have reservations even to look at the menu."

He nodded brightly. "Yup, that's the place."

"But we don't have reservations."

"Humor me. Let's call it an experiment. I'll bet that I can get you into the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

toniest places in town tonight, no matter how exclusive they may pretend to be. Want to try?"

"The Satin Dragon? For God's sake, Ron, now I *know* I ought to wear something else."

"Nope. You're wearing a Second Skin or I'm not taking you."

"OK, OK," she said reluctantly. "Let's see if we can get away with this."

Oriental food had never been Desiree's favorite, but a chance to eat at The Satin Dragon was too good to pass up. Only the elite ate there. It was certainly the place to see and be seen. She just wasn't sure that she was ready to be seen in a Second Skin. What if they threw her out?

Carson laughed at her when she mentioned her fear to him as they rode the slidewalk across town. "Throw you out? No way! Anybody who turns you away tonight will regret it."

"Ron, that doesn't sound nice. Surely you aren't going to threaten anyone."

He stared at her as though she were crazy. "God, no, Desiree." He shook his head. "Are you blind? With one resounding crash, you have instantly become the toast of the town. I daresay of all Luna. You will be welcome anywhere you go tonight. Tonight you can set precedents with a wave of your hand. If you were to eat standing on your head, by tomorrow evening half of the town would be doing likewise."

"Ron, quit exaggerating. I can't do any such thing," she protested.

"Wait and see."

There was a short line outside the Satin Dragon. Mostly people hoping that a reservation would be canceled. Carson sailed right to the head of the line with Desiree in tow. He acted as though he had every right to be doing so.

The man at the door was dressed in a severely cut black jumpsuit. His face had all the emotional range of a slab of stone. He had seen it all and was unimpressed by any of it. Lunar Commissioners were daily fare here and no lesser being stood a chance of cracking his facade.

Desiree was horrified to hear Carson matter-of-factly state that she was here for dinner. The expressionless eyes flickered past Carson's shoulder to weigh her against the others standing in line. She was sure that she would be found wanting.

"Wait here, please." He disappeared inside.

Carson turned and winked at her. She could feel the pressure of the stares on her back as the half dozen people in line scrutinized her mercilessly. She felt as though she were making a complete fool of herself.

A disembodied hand beckoned from the dim lighting within the portal. Carson led her inside as the man in the black suit stood aside to let them pass.

"We're in!" she whispered excitedly to Carson. "I can't believe it."

He grinned at her, barely seen in the dimness. "I told you so."

The maitre d' led them to a table. A real candle flickered in the center. "Will this be satisfactory?"

Carson nodded regally, a king to a peasant. "It will do."

The man held Desiree's chair for her.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

"Your waiter will be with you in a moment."

Desiree glanced around nervously, noting the stares of the people at tables around them. Some interested, some bored, some . . . she saw Edgar Rice at a table not far away. He nodded to her amiably and smiled, then said something to the man across the table from him who turned and looked at her appreciatively. She didn't recognize the man.

"Oh, Lordy, Ron. There's Edgar Rice," she said.

Carson snorted. "He's human, sweetheart. The same man you were speaking to the last night. Don't get thrown just because you're seeing him out in public."

Their waiter came and spoke with them briefly, answering Carson's questions about the selections on the menu. Carson ordered for both of them.

Desiree was subdued. She let Carson carry the conversation as they ate, half afraid that she would commit some unmentionable *faux pas*. Her nervousness made her clumsy. Carson pretended not to notice.

As they were finishing their dessert, he smiled at her and said, "Smile, Desiree, you're on."

"What?"

Just then she heard Edgar Rice's voice. "Good evening, Desiree. I hope you're enjoying yourself tonight."

Remembering just in time to turn on her smile, she looked up at him and replied, "Edgar! It's good to see you."

Rice gestured to the man at his side. "This is Commissioner Kent. He's over from New London for a meeting about the new Holmes Door technology."

Desiree stared up at the man, seeing only that he was Earth-born and handsome as the devil. The fact that he was also a Lunar Commissioner made him almost luminous in her eyes. He took her hand and pressed it to his lips. "Enchanted. Edgar has been telling me all about how you're going to take the fashion world by storm here on Luna."

Overcome, she managed to stammer, "All I did was put together some clothing. My mother would disown me if I didn't know how to sew."

Commissioner Kent smiled broadly. "Edgar assures me that you know quite a bit about sewing. From what I see tonight, I have to agree with him."

Desiree glanced down at her outfit. It certainly wasn't her most spectacular design, but in comparison with a jumpsuit it was flashy. She shrugged. "I might as well wear it—it's paid for."

Kent laughed. "Unlike some of our governmental purchases back in New London! Listen, Edgar and I are going over to a small club on the fifth level. I would be delighted if you and Mister Carson could find time to join us for a drink."

Desiree almost declined, but Carson caught her eye. "Why I'd love to. Tell Ron where it is. I'm still new here and I'm afraid I don't know my way around very well."

After they had left, Carson shook his head, chuckling. "First night out on the town and you hook a Lunar Commissioner. It'll all be downhill from here, Desiree."

"Oh, Ron! All he did was invite us to have drinks with him."

Carson laughed. "I think we should wait a bit before showing up. We

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

wouldn't want them to think we followed them over there."

"You mean you're seriously thinking about going over there?"

"You bet. You won't get a better chance to hobnob with the high and mighty. You're on a roll, Desiree, take it while it's hot."

When the computer woke her the next morning, Desiree couldn't decide whether it was the best morning of her life or the worst. She had a crushing headache from drinking too much the night before, but she was also in possession of Commissioner Hammond Kent's unlisted home number in New London. For the first time since she had gotten to Luna, she had found someone she thought was interesting. Actually she was more than interested—she was close to infatuation.

The more she thought about the previous night, the more she began to think she might have overdone it. They had gone to no fewer than six clubs during the evening—nearly exhausting the night life scene in Crisium. Everywhere they went more people joined their party.

The climax of the evening was painful to remember. A woman had marched up to their table and denounced her as a brazen whore, launching into a screaming tirade during which she told her that any woman who would be seen in public dressed the way she was would burn in hell forever. Desiree, more than a little drunk, had stood defiantly and told the belligerent bitch that if she were half the woman she ought to be, she would quit dressing like a man and put on some makeup.

The details of what was said next weren't clear in Desiree's memory, but she remembered the woman challenging her to prove that her Second Skin was good enough to hold air, if not her body. She had accepted.

Now, the next morning, she wasn't so sure that she should have accepted the dare, but the damage was done. Edgar Rice, who had been seated across the table from her, had offered to cover the event for the news. He was offering her free publicity. Surely that would be good for sales.

The time had been set for eleven this morning.

Desiree screwed her eyes shut and tried to wish herself out of existence. It didn't work.

East Lock had been decided upon as the location for her demonstration. When she got there, she was amazed to see over a hundred people milling around. Ron Carson was with her, but was even more subdued than she was.

Edgar Rice caught sight of them and hurried over, a cameraman trotting along behind him. "Are you ready?"

She nodded. "As ready as I'll ever be. This wasn't what I had in mind for a way to show off the new clothing, but I guess I'm in for it now. Up to my neck and then some."

Rice grinned. "Relax, Desiree. It'll be OK." He gestured back to the crowd. "We seem to have a bit of an audience. It would look better if you said a few words."

Desiree grimaced. "Great, just what I need. I can hardly remember my own name and you want me to make a speech."

"Tell them a little about the suit. A

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

short version of what you said at the show the night before last would be perfect.''

She sighed. ''OK. Suppose I stand on that crate so everybody can hear me?''

''Perfect,'' Rice assured her.

She hopped lightly up onto a crate stenciled SEALANT FOAM, hoping that her fatigue didn't show. ''Good morning, folks. I've been asked to show that my new clothes will actually hold air,'' she said, gesturing at her blue, skin-tight clothing.

Rice, standing beneath her, asked, ''Exactly how are you going to go about demonstrating your suit, Miss Stuart-Gwaltney?''

Glancing back up at the crowd, she said, ''These suits are *not* intended to replace a true vacuum suit—mainly because they will only hold the air that can be captured within the helmet. We estimate that an average adult can live for one, possibly two minutes with the extra air if they remember to breathe shallowly. Our intention is to give you a little more time to reach your vacuum suit. Since the suit is form-fitting,'' a wolf whistle came from the back of the crowd, ''you should have no trouble sliding into your suit. As a matter of fact, since there is so little extra fabric, it should be even easier than trying to get a jumpsuit into your vacuum suit.

''Naturally, I hope that no one will ever need the air-holding feature of this clothing, but in the meantime, you'll look great.''

A man midway through the crowd called out, ''All we need is for women to look better than they do already. There aren't enough to go around as it is!''

Desiree grinned at him. ''Well, you know how it is, keeping a man in a perpetual state of sexual excitement may not be the ultimate goal in a woman's life, but it sure is a good way to keep your bills paid.''

A general round of laughter told her she had the crowd on her side. She glanced down at Carson. ''Ron, check the seams on this thing. This would be a bad time to discover that I've got a leak.''

He nodded and started running his hand down the outside of her thigh, prodding the seam as he went. She held onto his other hand for balance.

Desiree glanced up at the crowd and quipped, ''You know what Mae West used to say . . . 'Give a man a free hand and he'll run it all over you.' ''

This time the laughter was stronger. She was feeling better about the demonstration now. Even her headache was receding.

Carson looked up and patted her shoulder. ''Looks good to me, Desiree. I'd say go for it.''

She nodded and looked back up at the crowd. ''OK, I'm going to go through the air lock. It will take about thirty seconds for the lock to cycle. Then I'll go outside and walk around for about thirty seconds and come back to the lock. By the time the lock cycles to let me back in, I will have been in the suit for roughly a minute and a half. The suit itself is good for longer, of course, but I won't be carrying any extra oxygen.''

She stepped down off the crate and walked over to the air lock. Carson took

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

up station at the air lock controls. "Ready?"

She nodded and took a deep breath. "Ready."

Reaching up, she unsnapped her collar. Immediately, the slightly springy plastic helmet folded free in her hand. She pulled it over her head and sealed the plastic zipper lock in the front. Carson had zipped her slippers on while she was still standing on the crate.

Smiling brightly, she waved and stepped into the air lock. The whine of the recycling pump began immediately, but faded as the air pressure lessened. The fabric of the suit made rubbery creaking noises as it adjusted to the change in pressure and began to seal.

The red light above the outside portal went out and the green one came on. She reached out and pressed the release and raw sunlight flooded into the air lock compartment.

Immediately, she was blinded. She made a mental note to herself to look into the possibility of including a photosensitive chemical in the hood to lessen the glare before she stepped out onto the metal tiled pad that surrounded the air lock.

There were soles on her slippers, but they weren't very thick. Not thick enough, at least, to insulate her feet from the metal.

She sighed—an eerie sound in the close confines of the helmet. Photosensitive chemicals in the plastic hood wouldn't be too bad, but if she started building up the slipper soles to handle being outside, she might as well go whole hog and design a complete vacuum suit. Some compromises would have to be made to keep the price down. After all, the normal environment for the suit would be in the city, not out on the surface.

Her feet were starting to get uncomfortably hot, as was the sunward side of her body, so she walked over to the shadow of a large sheet of plastic left over from when they had patched the hole in the wall during the blowout. Her feet began to get cold almost instantly.

She glanced at her watch. She had been out for only ten seconds. Twenty left to go. Unfortunately, there was not going to be any way for her to maintain anything like a reasonable temperature. She began to wish that she had thought of that before she had left herself get badgered into this silly demonstration. Walking back out into the sunlight, she turned slowly on her heel to spread the heat over her body instead of concentrating it on one side.

Inhaling was difficult. The suit resisted the movement of her ribs now that it had stretched tight. It felt as though she was wearing a too-tight corset.

The moisture in her breath tended to condense in the shadow of her head if she stood in one place. As long as it was behind or beside her head it was no problem, but when she tried to gauge time of the local Lunar day by the length of her shadow, it quickly condensed in front of her face.

She turned around again and waited for it to evaporate, then read her watch. Almost time to go in. She began to walk slowly towards the door. Her air was now getting noticeably stale even though she had been careful to breathe very shallowly. Moving quickly would only use it up more rapidly.

Peering through the window set into

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the outside hatch, she saw Edgar Rice's face pressed against the window of the one inside, just over an arm's length away. He seemed to be trying to tell her something. He looked quite worried.

Unable to tell what he was saying, she shrugged. He redoubled his efforts, using his hands to point in her direction and making sideways motions. Puzzled, she shrugged again. Whatever he was trying to tell her wasn't making any sense.

A burning sensation in her feet prompted her to look at the soles of her slippers. Worried, she lifted one foot and looked at the sole. The plastic tread had begun to melt. Now, *that* was going to be a problem.

She looked back in at Rice and saw him gesturing frantically at her. Unable to get his meaning, she made gestures of her own, trying to indicate that her slippers were melting. Clearly he was unable to tell what she was saying either.

Why weren't they opening the hatch from the inside as had been agreed? Confused, she hit the button next to the hatch. Nothing happened.

She frowned and glanced at her watch. She began to worry. The air in her helmet wouldn't be good for much longer and apparently something was wrong, although she couldn't tell what from Rice's signals.

If the lock was malfunctioning, she did not have too many options. If she had enough air, and if her slipper soles would hold up, she could walk to one of the other city air locks. South Lock was probably the closest, but even that was far beyond anything she should attempt on the limited amount of air that she had left. As a matter of fact, it was more than she could reasonably attempt even with a fresh helmet of air.

Each breath was coming harder now. It almost felt as though there were less air to breathe, even though she thought that this had to be an illusion. Her lungs, however, insisted that there was virtually nothing left as they labored to fill. The sound of her breath was becoming louder in the tight confines of the helmet.

She leaned against the air lock, trying to ignore the fact that her feet were on fire. Vaguely, she remembered having heard that the surface reached temperatures of roughly 250 degrees Fahrenheit during the Lunar day. Would the metal tiles get hotter than that, or would they be cooler. . . ?

Wearily, she turned her head to look through the glass. It took ages for her eyes to focus on Carson's face, seemingly only a few inches away. He looked so worried, but she couldn't figure out why. For some reason it was strange that he should be so close.

Suddenly, the portal wasn't propping her up any more and she fell sideways into the lock. Some part of her mind was frantically telling her right arm to break the fall, but it would not respond.

Hands under her armpits dragged her the rest of the way into the lock and the door slid shut behind her, mercifully blocking out the glare of the Sun.

On her back now, she saw Carson slam the bright yellow button that said EMERGENCY OXYGEN FLOOD with the heel of his palm. Almost immediately, there was a faint scream as high pressure air jetted into the compartment. The

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

sound got louder as the air pressure increased, deepening into a roar.

Her plastic helmet made crumpling, crackling noises and tried to collapse around her face. The plastic pressing against her nose was somehow more alarming than the fact that there was no air left to breathe and she made feeble clawing motions to try and pull it away from her face.

There was enough air now that she could hear Carson cursing in a steady monotone. His hand brushed hers aside effortlessly and tugged at the end of the zipper seal at the side of her throat. There was a slight pop as the air exchanged.

Suddenly there was air she could use. The pressure was still low compared to what she was accustomed to, but at least there was sufficient free oxygen that her body began to respond. The pressure on her chest decreased as she filled her lungs. Her whooping breaths sounded harsh and strange to her.

Carson flipped the seal on the helmet of his vacuum suit and threw it into the corner. "Desiree?"

"Go 'way."

She heard talking in the background as the inside portal ground open, but it was too much trouble to respond to it.

"Desiree, how do you feel?"

This required a vast amount of mental effort. After two or three centuries had passed, she said, "Awful. My head hurts."

There was more muttering in the background, but again it was easier just to ignore it.

"Desiree, open your eyes."

She tried to shake her head, but it weighed as much as a car. A cold finger pulled back her eyelid and shone a bright light into her eye. That got through to her. She screamed.

It was a faint scream, to be sure, but the finger released her eyelid. She considered calling the owner of the finger some impolite names, but it was more trouble than it was worth to decide exactly what to call them. Then again, she could cuss them out more effectively if she knew what gender they were, so she opened her eyes and tried to sit up.

As soon as she made a motion, there was a helping arm behind her back to assist. She was glad, because for some reason she thought she must be back on Earth. It was so much trouble to move.

She waited until she was sitting upright, propped against the side of the air lock before she opened her eyes. The first person she saw was Ron Carson. That was no surprise. Edgar Rice was shouldering in next to him. There were six or seven other people trying to crowd into a space that was only designed to hold three people, but she didn't recognize any of them.

"Ron, if you don't like me, just say so . . . you don't have to try to kill me to get the point across," she said.

Carson tried to smile. "There was a short in the wiring and the air lock wouldn't cycle. They had to do some very quick work indeed to get it open."

"It was an unanticipated problem left over from when the man burst through the wall a few weeks ago," Rice added.

"Oh." There didn't seem to be much else to say.

"Can you stand up, Desiree? We—"

"Excuse me, excuse me, I need to get in there." People were being bodily

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

picked up and set aside as someone new forged into the air lock.

"Hammond!" Desiree whispered.

"I came as quickly as I could. I heard about it entirely by accident as I was getting out of my meeting." He smiled shyly, quite unlike his self-possessed behavior of the previous evening. "Don't scare me like this, Desiree."

Desiree smiled. "Never a dull moment, Hammond."

Leaning down between Carson and Rice, he gently kissed her forehead. "You nut! You could have been killed!"

She made a small shrug. "Talk to the guy who busted the air lock. All I did was go for a walk."

He grinned. "Smart ass."

"So *that's* where my brains have been hiding all these years! Lordy, Hammond, I'm so glad you figured that out for me. . . ." she teased.

Carson glanced over at Rice and said, "I think she'll live."

Rice shook his head in disbelief. "Nine lives. Eight now, I guess."

Desiree smiled at them. "Gentlemen, I've always believed that a woman should have a full stable of men, but *really*, three at one time is too much, even for me. Could we possibly get out of this dreadful air lock?"

Without another word, Kent scooped her into his arms and carried her out into the crowd. She called out, "It's OK, folks. Just a bit of showmanship. Had to make sure you got your money's worth."

A cheer went up as Commissioner Kent carried her through the press of people and strode off down the corridor, Carson and Rice bringing up the rear.

* * *

The next morning seemed anticlimactic to Desiree. The past few days had seemed almost like a holiday—a vacation from the day to day routines of selling. Now she had to get back in harness and do the behind the scenes work that would make the new line a success. Already, paperwork was piling up faster than she could even glance at it.

Sammy Nichols brought in a batch of papers and placed them diagonally on top of another pile. "These only need to be signed, Desiree," he said apologetically.

She looked up and sighed. "And to think that the computer was supposed to usher in the paperless office back in my grandfather's day—it still hasn't happened."

He grinned. "Well, I suppose singlehandedly creating an entirely new industry could be a little tiring."

"I'll let you know if the strain becomes too much."

Nichols snapped his fingers. "Oops, I forgot the purchase orders for the slippers." He slid back out of her office.

Desiree smiled to herself and turned back to the seemingly unending details that all needed to be attended to at once. When she heard Nichols return, she said without looking up, "Just put them on the pile, I'll look at them as soon as I can."

A small bunch of roses landed exactly in the center of the report she was reading. "I wanted to bring you a dozen, but there were only five to be had throughout the entire city. Will you take a rain check for the other seven?"

Desiree's head snapped up. "Hammond! What are you doing here? I

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

thought you were going back to New London as soon as your last meeting was over."

Boyishly grinning, he said, "Oh . . . that. Well, you see, the meeting ran over and I missed the shuttle, and the next one isn't until the morning. Since I had to stay over another day. I thought that I would drop by to visit. Or something like that."

"Oh, Hammond, you're sweet."

"There's one other thing."

"What's that?"

"I wanted to ask you to go out to dinner with me tonight, but there's a condition."

"What's the condition?" she asked.

"You have to promise me, on your honor, not to take up any more challenges to prove your new suit."

"I think I can handle that. Under the circumstances I wish I hadn't done it this time."

"Oh, I don't think it'll turn out that badly in the long run. Ron tells me that the publicity resulting from your demonstration has led to quite a few inquiries about the Second Skin suits."

"Good. Maybe it wasn't all for nothing, then."

"No, it wasn't, Desiree. Even if you never sold a single suit."

"Why, Hammond?" she asked, wanting nothing more than to hug him.

He shrugged, all elaborate innocence. "Simple, my dear. I got to meet you, and I've got plans for us."

Desiree's smile lit the office. Suddenly Crisium didn't seem so small any more. ■

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION (Required by 39 U.S.C. 3685)

1. Title of Publication: ANALOG SCIENCE FICTION/SCIENCE FACT. Publication No. 01612328.
2. Date of Filing: October 1, 1990. 3. Frequency of Issue: Every 28 Days with special issues in January and July; (A) No. of Issues Published Annually: 13; (B) Annual Subscription Price: $34.95.
4. Complete Mailing Address of Known Office of Publication: 380 Lexington Avenue, New York, NY 10168.
5. Complete Mailing Address of the Headquarters or General Business Offices of the Publishers (not Printers): 380 Lexington Avenue, New York, NY 10168.
6. Names and Addresses of Publisher, Editor, and Managing Editor: President: Joel Davis, 380 Lexington Avenue, New York, NY 10168; Editor: Stanley Schmidt, 380 Lexington Avenue, New York, NY 10168; Managing Editor: Tina Lee, 380 Lexington Avenue, New York, NY 10168.
7. Owner: Davis Publications, Inc., 380 Lexington Avenue, New York, NY 10168; Davis Communications, Inc., 380 Lexington Avenue, New York, NY 10168; Joel Davis, 380 Lexington Avenue, New York, NY 10168.
8. Known Bondholders, Mortgages, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages, or other Securities: NONE.
10. Extent and Nature of Circulation: Average No. Copies each Issue During Preceeding 12 Months: (A) Total No. Copies Printed (Net Press Run) 129,526; (B) Paid Circulation: (1) Sales Through Dealers and Carriers, Street Vendors, and Counter Sales: 14,938; (2) Mail Subscription: 68,297; (C) Total Paid Circulation: 83,235; (D) Free Distribution by Mail, Carrier or Other Means Samples, Complimentary, and Other Free Copies: 1,427; (E) Total Distribution (Sum of C and D): 84,662; (F) Copies Not Distributed: (1) Office Use, Left Over, Unaccounted, Spoiled After Printing: 4,875; (2) Return from News Agents: 39,989; (G) Total (Sum of E and F should equal net press run shown in A): 129,526.

Actual Number Copies of Single Issue Published Nearest to Filing Date: (A) Total No. Copies Printed (Net Press Run): 118,758; (B) Paid Circulation: (1) Sales Through Dealers and Carriers, Street Vendors, and Counter Sales: 14,590; (2) Mail Subscription: 68,463; (C) Total Paid Circulation: 83,053; (D) Free Distribution by Mail, Carriers or Other Means Samples, Complimentary, and Other Free Copies: 789, (E) Total Distribution (Sum of C and D): 83,842; (F) Copies not Distributed: (1) Office Use, Left Over, Unaccounted, Spoiled After Printing: 2,011; (2) Return from News Agents: 32,905; (G) Total (Sum of E and F should equal net press run shown in A): 118,758. I certify that the statements made by me are correct and complete.

ELIZABETH BEATTY
CIRCULATION DIRECTOR

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

the reference library

By Tom Easton

The Shield of Time, Poul Anderson, TOR, $18.95, 359 pp.
Mission: Tori, Johanna M. Bolton, Ballantine/Del Rey, $3.95, 233 pp.
Hero, Joel Rosenberg, ROC, $18.95 hard, $8.95 trade paper, 206 pp.
Winterlong, Elizabeth Hand, Bantam, $4.95, 440 pp.
Mazeway, Jack Williamson, Ballantine/Del Rey, $17.95, 292 pp.
Good Omens: The Nice and Accurate Prophecies of Agnes Nutter, Witch, Neil Gaiman and Terry Pratchett, Workman, $18.95, 354 pp.
Phule's Company, Robert Asprin, Ace, $3.95, 232 pp.
Lion Time in Timbuctoo, Robert Silverberg, Axolotl (Pulphouse Publishing, Box 1227, Eugene, OR 97440), $10, 112 pp.
Through Darkest Resnick with Gun and Camera, Mike Resnick, Washington Science Fiction Associaton (WSFA Press, % Covert Beach, 1200 Waynewood Blvd., Alexandria, VA 22308), $35, 200 pp.
On Spec: The Canadian Magazine of Speculative Writing, Marianne O. Nielsen, ed. (P.O. Box 4727, Edmonton, Alberta, Canada, T6E 5G6), $5 per copy, $9 per year (two issues), 88 pp.
Algorithm, A. K. Dewdney, ed. (2 Oxford Street West, London, Ontario N6H 1P9, Canada), $29.95 (U.S.) per year (6 issues).
Books on Disk

Among Poul Anderson's wealth of stories are several that involve the Time Patrol and its efforts to preserve the true line of history from disastrous changes. Now he gives us his first Time Patrol novel, **The Shield of Time**. Manse Everard has recently saved Wanda Tamberly from a conquistador who had stolen a time cycle, figured out how to use it, and planned to bring a few modern weapons back in time. He has also gotten her into the Patrol as a trainee and now, despite a yen to hang around, he is off to 209 B.C. to catch the villains who plan to bring all history down in flames. That mission accomplished, it

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

is Wanda's turn to study the changing fauna of Beringia some 15,000 years ago, where she meets the first Paleo-Indians on their way to North America, witnesses with dismay their high-handed treatment of the local primitives, and tries to convince her superiors—including Manse—to intervene.

Manse and Wanda are developing a relationship by now. The attraction is mutual. It is thus rather upsetting to Manse when Wanda takes off from the Patrol's Pleistocene rest-camp just as the word comes in that the history they know has vanished. Quantum fluctuations in the late Middle Ages have thrown everything off the track, and Manse must, despite pain and anguish, work to set things right even though, if Wanda does not return in time, she will never have been except in his memories.

It's a great excuse for a romp through history, and it lets Anderson play nicely with the idea that history may pivot on one lone individual, though the identity of that individual may not be at all obvious.

It feels much more like a trio of related novellas than a real novel, but don't let that bother you. It's a fun read.

Asteroid belts where the rocks are so thick that any ship that dares to try to cross the belt is necessarily pummeled into scrap. Belts where strange radiation fields warp the very nature of reality and throw off every instrument a spaceship possesses yet are harmless to a human being protected by no more than a spacesuit. Belts that so totally englobe a sun that a ship cannot dodge them simply by moving out of the plane of the ecliptic. Invisible aliens that can make humans see buildings, robed strangers, even a world and a sky that do not exist, and then invade and seize human minds. Currently unknown elements obtainable only from rare ores, or perhaps chemical compounds that a far-future technology is unable to synthesize.

Did you think that such ludicrous things disappeared from SF long ago? That modern SF writers had some sense of the three-dimensional structure of a solar system, of the spacing that must develop in any asteroid belt that remains stable for any prolonged period, of the nature of possible radiations and the periodic table, of the synthetic capabilities of *current* chemistry, of the sheer implausibility of immaterial brain invaders?

Such things are what once gave SF a well-deserved reputation as so much silly tripe. Such things have indeed been left behind by every writer who cares about craft, SF, or intellectual responsibility. Sadly, however, they *are* still with us.

I offer you Johanna M. Bolton's **Mission: Tori** as the bad example of the month. Tori is a world enwrapped by the stonefield, the asteroid belt famous for its density and radiation fields. It is supposedly rich in the rare mineral tridenite, and it has natives who seem quite eager to negotiate a treaty with the Federation. Unfortunately, the negotiating team has disappeared, and there was only one brain-scrambled survivor of the follow-up mission.

Enter secret agent Mier Silver, empath, possessor of eyes so sensitive that they see perfectly well in total darkness (vision *always* needs at least a little light). Silver, who has only been able to work alone ever since she lost a partner and lover, is paired with HAC, supposedly a Human Analog Computer, and sent to Tori. Her mission is to find out what happened and get that treaty; she is warned of a security leak and told

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

that the Federation's enemies want the prize as well.

Few readers will be surprised at the way the mission turns out. More, I hope, will be appalled by the author's attitude toward technical verisimilitude. Not recommended.

Joel Rosenberg's **Hero** is much, much better. It is set in the same interstellar civilization as his *Not for Glory*, in which he introduced Metzada, an inhospitable world settled by Israelis and Japanese exiled from Earth. The Metzadans are mercenary warriors who use only that military technology indigenous to the worlds that hire them. The earlier novel made it clear that they fight only in order to ensure their own survival—glory is not their aim—and made the worthwhile point that survival is the only legitimate justification of violence.

That point remains visible in *Hero*, but it struck me as subordinate to the glorification of violence. Ari Hanavi is a younger son sent with two older brothers and a Metzadan force to aid the Casalingpaesans, a people of Italian stock, in a war against the German-derived Freiheimers. The Metzadans are to train the Casas, not to fight, but as soon as they arrive they are ambushed by Freiheimers. Ari freezes under fire and establishes that he is a coward. The Metzadans go to a combat footing, and Ari freezes again.

Obviously, Ari is not a proper Metzadan. Is there any way to save him? To help him conquer his cowardice? Rosenberg suggests that such an individual can only be shot or promoted. Ari's superiors drum another coward, who differs from Ari only in that he lacks family with the clout to protect him out of the corps; he later commits suicide. For Ari they choose the latter course, giving him command of a small detachment of exhausted troops, ordering him to take a town, and then, when it is time for the boy to charge, calling in enemy fire to scare him into action. Not surprisingly, Ari comes through in the clutch. It's OK to run, as long as you run *toward* the enemy.

I enjoyed this one, even though the cover blurb and story structure make the tale quite predictable. Rosenberg's writing is smooth and deft and vigorous and his characters, though they have relatively little depth, are sufficient unto their roles. Yet I cannot recommend it without reservation. The emphasis seems far too much upon the macho thrill of murder, from the interrogation scene near the beginning (which turned the stomach of the too-civilized United-Nations-equivalent observer) to the slaughter of the Casa loyalty squad. I have to call it conanism and admit that the pleasure I took in it was a guilty pleasure.

It is a sad truth that violence and courage under fire are sometimes necessary. There was, for instance, no other way to defeat Hitler. Yet I do not think—and you may call me an effete, limp-wristed pinko if you must—that we should wallow in blood. We owe it to our better natures to seek other ways to handle conflict.

Elizabeth Hand doesn't wallow in blood in her first novel so much as she wallows in sheer, perverse nastiness. **Winterlong** dwells at such great length on the essential identity of beauty (life) and corruption (death) that the phrase it forces to mind is "the flowers of evil," and no matter that a Frenchman used it first.

Winterlong is dark fantasy with a science fiction background. It is set many centuries hence in a Washington, D.C., changed by war after war to a forest of flesh-eating plants, giant slugs, and vast

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

ruins, among which still survive museums, the Smithsonian castle, the zoo, embassies, and other major buildings. These places are inhabited by people who vaguely recall the actual functions of their homes and try to live as their predecessors must once have done, even though they can do little more than go through the motions quite futilely, self-indulgently, mindlessly. The populace is of Curators and Regents and Botanists and Paphians, those whores—in a word—whose business it is to give pleasure to the others. Society is an endless round of masques and other parties held beneath periodic rains of roses, floral-scented clouds of viruses and mutagens that kill many[1] and warp the survivors into the dying, cannibalistic lazars. In the shadows lurk "gene-slaves," relics of past tampering with genetic engineering.

The story opens outside the city, at the Human Engineering Laboratory, HEL, where scientists use mad children to cure disturbing dreams. The children's brain neurochemicals are manipulated, and they can read memories and feelings in a taste of blood. One of these children is Wendy Wanders, autistic empath; as a child, she and her twin brother fell into the hands of a Pathian House which kept the boy but sold her to the experimenters because her autism made her useless as a whore. Some of her patients commit suicide, and in one patient's dreams she meets a green-eyed boy who seems linked to death. The government becomes intrigued by her fatal power and takes over the research project, hoping to bottle her talent as a weapon. She flees to the city, where in due time she joins an acting troupe.

Meanwhile, her brother Raphael Miramar, ace catamite, has left the bordello for a master who dangles learning as bait. When that relationship crumbles, he falls into the hands of lazars and the Madman of the Engulfed Cathedral, who slaughters children at a whim and dreams of ending all human history. Raphael plays the role of the Hanged Boy, the Gaping One, the sacrificial god, Death, and he is bait for his sister, embodiment of the Magdalene, life and love and beauty.

The prose is rich, the characters baroque, the flavor reminiscent of Gene Wolfe spiced with Lovecraft. Yet these very qualities contribute to what may be the tale's greatest problem: Hand makes the darkness of her vision black and decadent, sets it aglow and reeking with the green and purple phosphorescent vapors of putrescence, and she thus convinces. Indeed, she convinces so thoroughly that at the end, when she bids her readers lift up their eyes unto the light, they can see only a little above the level of their knees. The stink is still there, the endless muck and slime and decay, and the light, beyond the merest hint, remains elusive.

If Hand is not the most pessimistic of us all, she still has a bit to learn about balance and contrast. But either way, *Winterlong* is a powerful experience, Hand has a marvelous career ahead of her, and its next step is billed as *Aestival Tide*. Watch for it, and for her.

Jack Williamson is a Grand Master of science fiction (so anointed by the Science Fiction Writers of America, Inc.) who has been writing SF for over 60 years. You'd think the springs would run dry but, *mirabile dictu*, he keeps getting better and better. And that makes him a remarkably rare bird.

Does he *really* keep getting better? I can hear you wondering, and I have

[1] In one of Hand's few clumsy steps, her viruses and mutagens work instantly, acting much more like nerve gases despite their name.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

to admit there is a bit of hyperbole in the line. *I* think what he writes now is better than what he wrote in 1928, than much of what he wrote later on. You may point to his *The Humanoids* (1949) and ask how he could possibly top it. My answer is that his current attitudes are more mature, the prose more polished, the story-telling smoother, defter, more assured. If his current ideas seem a little less fresh, well, so many ideas have been laid out in the last 60 years—many of them by Williamson himself—that there just isn't the room there used to be to seem fresh and innovative.

Mazeway is a sequel to *Lifeburst*, in which a biomechanical creature rather like the queen of an ant colony invaded the solar system. This Seeker Queen's aim was to convert the system, including Earth and its inhabitants, to progeny. Fortunately, a human was able to destroy her, though not before civilization was destroyed. At the same time, other humans were discovering a vast multi-species culture in the cometary Halo.

The Eldren, the "people" of this culture, are immortal, they are physically adapted to the space environment, they have learned that survival means cooperation, not combat. Humans therefore do not fit, though they wish to, for being accepted among the Eldren means survival and a chance to adapt fully to space. Ben Dain, born in the Halo, learns of Mazeway, the twin worlds where the Game of Blade and Stone is played to test new species for their suitability to join the Eldren and to teach them the Eldren Way. He decides to play the game on behalf of humanity, but before he can go to Mazeway disaster strikes. New aliens arrive in the Halo, the receiving station goes dead, a nonsentient robot turns sentient. On Earth, a Mazeway native, Nebo, recruits two bloody-minded heirs to the disaster and conspires to use them to gain title to the planet's mineral wealth.[2] They too will play the Game, as will the strange aliens and the robot.

The outcome is predictable. The nice guy wins. He gets the girl. The Eldren are saved again by mere humanity. And Williamson assures us once more that no matter what once unimagined dangers may await us Out There, no matter how much damage they do, we *can* survive.

Terry Pratchett is the Englishman responsible for the Discworld series, silly, funny, mock-heroic fantasy that enjoys a very nice niche in the marketplace. Neil Gaiman writes comics just as successfully. And when they get together, they must have a high old time. The evidence is **Good Omens: The Nice and Accurate Prophecies of Agnes Nutter, Witch.**

Eleven years before Armageddon is scheduled, Satan's minions plant the Antichrist in a maternity ward run by satanist nuns. As the result of a classic baby switch, the kid winds up in a happy suburban home, while the human child gets the satanic nanny and tutor. Meanwhile, Crowley, a demon who rather enjoys life among us mortals and isn't all that keen on seeing Earth destroyed, joins hands with his old friend Aziraphale, a bibliophilic angel who also likes things just fine the way they are. Anathema Device, witch, owns the only extant copy of Agnes Nutter's very accurate book of prophecy. Newton Pulsifer drives a horrendous lemon of a car with "Dick Turpin" emblazoned on the

[2]Why Earth? Why can't Nebo's people use Mars, Mercury, the asteroids, and other such rocky bodies? Williamson does not say.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

door,[3] yearns for meaning in his life, and joins the enfeebled Witchfinders Army. Adam, Antichrist, is half imp, half angel, pure boy, very human. The Four Motorcyclists of the Apocalypse (have to be up-to-date, don't you know) ride out of the mists. Newton meets Anathema. The heavenly and satanic hosts gather. Adam decides he doesn't want any, thanks. And . . .

If you've read any of Pratchett's other books, you know what this one tastes like. If you haven't, well, it's zany and flip. It's almost Wodehousian. It sends up so many different people in so many different ways that one easily gets the idea that England has twice as many nitwits per square meter as, say, New York or Washington.

That is, it's quite amusing. In addition, it actually makes a good deal of sense as commentary on human nature. It is therefore rather more than mere farce.

Robert Asprin is also quite a successful writer, with the *Thieves' World* and *Myth-Adventures* series to his credit. **Phule's Company** introduces a third series intended to be funny but not quite so bizarre as the *Myth* tales. The premise is a company of Space Legionnaires made up of assorted misfits, losers, and hard-cases. Willard Phule is a young mega-millionaire Legionnaire[4] who screws up royally enough to be given command of the company. Immediately, he begins to turn the misfits around with large doses of money, respect, encouragement, leadership, and of course more money. As you might expect from Asprin, there is plenty of room for misunderstandings, mistakes, missteps, and other misadventures. The result, while Phule's collection of uncooperative troublemakers is not nearly bad enough to live up to their advertising, is reminiscent of "M.A.S.H." and other TV situation comedies. That is, it's funny enough, but you may feel the lack of a laugh track.

The latest of Axolotl Press' limited edition novellas is Robert Silverberg's **Lion Time in Timbuctoo**. It hardly seems like science fiction, until you realize that its world is very different from our own. The setting is an Africa dominated by home-grown cultures, free of a colonial history, because the Black Death depopulated Europe more thoroughly than in our past. The Ottoman Turks ruled Europe all the way to England, and the Americas were left alone. Thus when the Emir of Timbuctoo lies near death, the ambassadors that arrive for the imminent funeral are Incan and Aztec as well as Turkish, Russian, and Chinese. There are also emissaries from numerous satellite countries and from a newly independent England.

The English hate the Turks, but the Turkish ambassador brought along his daughter, the mischievous Selima. Against all sense and propriety, the junior Englishman, Michael, is smitten. Selima takes up with the Emir's decadent, wastrel son. Michael learns of a plot to assassinate the heir, and when Selima finally turns her wiles upon him, he . . .

It's a tale of political and social intrigue that uses an exotic setting in a very explicit way. For other ways to use the mystery and strangeness of Africa, consider . . .

* * *

[3]No, I won't tell you why. But here's a hint: Dick Turpin was a highwayman. Now, what do highwaymen do?

[4]Why is he in the Legion, which by tradition takes anyone, many of them on the run from the law? There is no clue, though I suspect Phule is doing the research to write a best-seller management manual.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Five hundred copies of **Through Darkest Resnick with Gun and Camera** were published by the Washington Science Fiction Association in honor of Mike Resnick's guest-of-honorship at the 1990 Disclave. It's a nice account of the African influences on Mike's work, along with the diaries of several of his African safaris, an invaluable amount of good advice (if you're thinking of such a safari yourself), excerpts from *Adventures*, *Paradise*, and *Ivory*, and two of his Kirinyaga stories. It's therefore essential for anyone who's trying to collect Resnick material.

Don't act surprised if you run into this one in paperback. Just grab it.

It's not cheap at $5 a copy, but it does contain some nice stories and poems and it's worth supporting. For Canadian writers, it's also one more place to send work. It's **On Spec: The Canadian Magazine of Speculative Writing**, with Marianne O. Nielsen as the general editor.

The fiction contributors include John Park, Wade Bell, James Alan Gardner, Jamie Findlay, J. Brian Clarke, Diane Mapes, Alan Barclay, and Susan Sharpe. The story I liked best was *Analog* writer Clarke's "Transference," which supposes that from time to time we—all of us—slip from parallel world to parallel world. When a classic and mad inventor devises a way to tour the possibilities, there's a large explosion and . . . The end result might be called a new twist on the old "But then I woke up" ending. Another enjoyable one was Gardner's "Muffin Explains Teleology to the World at Large," in which divinity inexplicably descends on a small girl.

I would also like to call your attention to another new small magazine, **Algorithm**. The editor is A. K. Dewdney, the "Mathematical Recreations" columnist for *Scientifc American* and author of *The Planiverse*, and that alone should give you some idea of the magazine's contents. It offers guidance on programming and playing with fractals, chaos, strange attractors, randomly generated "gardens," checkerboard worlds, and more. Dennis Shasha contributes puzzles starring the famous Dr. Ecco. Each issue contains a computer- or algorithm-related short story, "Algofiction," that might be at home in *Analog*. And the ads can steer you to some very interesting software packages.

If you want to check it out, a 6-issue subscription costs $29.95 (US), but single issues are available for $5.

BOOKS ON DISK

You may be pardoned for wondering whether the recent burst of disk-top action in this column is because I have just discovered the phenomenon or because the phenomenon has just begun to hum. The answer seems to be that previous attempts to get disk-top publishing started just did not get very far. The reason for their failure may be simply that there was not yet a workable way to present a book on a computer screen. This problem has now been solved by several people, most successfully by Ted Husted (IRIS). The disk-top action I'm covering is indeed new, and I'm delighted to be able to blow the horn for it.

Whether there is a market for disk-top books is quite another question. So far, the indications suggest that people prefer hand-held paper books—usable on the beach, in the tub, in bed, in a hammock—to sitting up in front of their computer. Disk-top may not really hit until someone markets a cheap, battery-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

powered, book-sized reading machine.[5] On the other hand, it's usable now, and it represents an entirely new level of access to "print" media for the visually impaired and the physically handicapped.

For those of you who would like more information about disk-top publishing, you can get it on a 5.25 inch IBM-compatible disk. For $4, John Galuszka (Serendipity Systems, P.O. Box 140, San Simeon, CA 93452) will send you **The Electronic Publishing Forum**, a compendium of position statements, contributors' guidelines, available titles, and more from various disk-top publishers. The first issue covers Serendipity itself, UserWare, High Mesa (which offers a disk-based book club, among other things), and Writers Online, a Bulletin Board System for writers that includes an electronic small-press literary magazine. There's also a "Disk-Based Books in 'Print' " section that lists even rumored titles. Future issues of the quarterly *EP Forum* will expand coverage, making it a prime resource in this area. Eventually, judging from complaints in the letter section about the general quality of disk-top fiction, it will have to add a review column. Then some computer marketer (such as Radio Shack) will bundle a copy in with its machines and disk-top will take off.

The second issue of Roleigh Martin's IRIS-based **ShareDebate International** (Applied Foresight, Inc., P.O. Box 20607, Bloomington, MN 55420; $5 an issue; $25 for a one-year subscription) is now available, with articles on free speech, entrepreneurial democracy, and the promise of smart cards for beating drug abuse (through the 'paper' trail), and a reprint of a Ben Bova[6] piece on magnetohydrodynamics. The lengthy discussions benefit greatly from synopses. There is also now a way to take notes as you read, a feature that no print magazine can offer (at least, as part of the magazine). ■

[5] I don't expect it will be much longer before we see a real "cyberbook." And yes, as soon as a manufacturer sends me one, I'll review it. It will have to be MS-DOS compatible and use 5.25 inch disks in order to take advantage of the existing disk-top material.

[6] Remember, he's the patron saint of disk-top publishing.

●Learning to learn is to know how to navigate in a forest of facts, ideas, and theories, a proliferation of constantly changing items of knowledge. Learning to learn is to know what to ignore but at the same time not rejecting innovation and research.

Raymond Queneau

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

brass tacks

Dear Dr. Schmidt,

I was fascinated with your attack against "extrapolatio ad absurdum" (May 1990 editorial). Your point seems to be that extending an argument to its furthest extreme is hardly a foolproof way to test the argument's validity. I heartily agree.

It's true that *any* political proposition can be nullified using extrapolatio ad absurdum. Obviously, a test of logic that nullifies every proposition it tests is not very discriminating and is not very useful. But extrapolatio, minus the ad absurdum, is a powerful tool, often our only tool when we try to guess at the social consequences of any particular law or policy. The value of extrapolatio, then, depends on the quality of the thinking that went into it and the accuracy of the social assumptions that it makes.

Extrapolatio is a social hypothesis. Its acceptance depends on whether or not the public accepts the quality of the thinking of the extrapolator and the validity of his assumptions. Sadly, in the so-called "soft sciences" of sociology, criminology, and political science, little else other than extrapolatio is available. True, we have statistics and studies, but such data must be interpreted and their implications, if accepted, must be extrapolated into the future; such skills may determine the survival of our species.

And so it is essential that we teach our children the skills of critical reasoning. Critical reasoning is a lot more than manipulating symbolic logic or analyzing rhetorical devices. Critical reasoning involves our perceptions of the world, of humanity, of current events, of history, of personal values. Nothing else will do in the face of often agonizing social decision making.

Where is the line dividing extrapo-

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

latio and extrapolatio ad absurdum? I don't know. Critical reasoning must answer that question on a case-by-case basis.

GREGORY J. ROSENTHAL
Rockville, MD

Dear Mr. Schmidt:

First, there's no need to add a fake Latin name to a phenomenon with so many evocative English ones: the camel's nose, the thin wedge, give them an inch, et cetera (May editorial).

Second, you haven't demonstrated that the fearful ones do us an injustice. To take your example of surgery: no one stopped "the Love Surgeon" from deliberately mutilating all his woman patients for years. Nurses and others had reported him, but nobody was going to examine a surgeon based on the word of a mere nurse. Medical associations and bar associations, like the medieval guilds before them, have turned into protective societies, if they weren't that way to begin with.

Mind you, I agree that you're running on luck and nothing else, with the ignoramuses we have making decisions. But neither you nor anyone else has come up with a means to keep those same ignoramuses from deciding what the job qualifications will be. And these bastards are *not* stupid. They're ignorant about doing the job because they've concentrated exclusively on getting the job; they will *not* hold still while you or anyone else shoves them away from the trough. And they *will* go to any extreme, in any field or with any discovery or invention, to get more power or to protect the power they already have.

Anyone can come up with a better system than the one that put a third-rate movie actor in the White House. The trick is to install it without disaster. And until someone figures that one out, the safest course is to expect stupid extremes from anyone in power.

LEE BURWASSER

First, while my topic was related *to "the camel's nose," it is* not *the same thing. Hence the different name. Second, of course surgery, like anything else, is sometimes abused. The solution, as I think even you would agree (at least while suffering acute appendicitis), is to guard against the abuses,* not *to ban surgery outright.*

While we're bandying about evocative English names, I submit for your consideration "The baby and the bath water. . . ."

To the Editor:

I greatly enjoyed reading G. Harry Stine's article, "Skunk Works," in the June issue. I wish to draw Stine's attention to another classic example of a "skunk works." This particular example was the development of the Sidewinder missile by Bill McLean and his small team operating in a shop near China Lake, CA. The missile was developed for a fraction of the cost of comparable military hardware. Larger teams with far more money and support failed to develop a missile as successful as the Sidewinder has been. The article by Ron Westrum and Howard A. Wilcox appears in the Fall 1989 issue of *American Heritage of Invention & Technology.*

CHARLES D. GATES
College Station, TX

The author replies. . . .

Dear Stan:

In response to Charles Gates's letter about William McLean's development of the Sidewinder missile at China Lake, California in the 1950s, I am well aware of it. I was the Navy's flight safety engineer at White Sands when the Sidewinder was brought there for testing against QF-80 drone aircraft. At that

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

time, the USAF was trying to get its "Falcon" air-to-air missile to work without much success. The Air Force people were highly skeptical of the simple Navy Sidewinder. That ended when the Navy shot its first Sidewinder at a QF-80, knocked it out of the skies, called for a second QF-80 launch, and knocked the second drone out of the sky with the second missile. The Air Force thereafter refused to supply any more QF-80 drones for Navy slaughter. In all charity, it must be said that the USAF recanted and adopted the Sidewinder which is still flown on USAF fighters today, long after the Falcon missile is no more.

The problem with listing all the Skunk Works operations that took place in the 1950s is the fact that, in 1,500 words, I couldn't list them all. What I concentrated on was the concept that if we really want to get things done, we need to dust off the old Skunk Works concept and put it to work again. Then we might get something done in the space transportation field.

G. HARRY STINE

Dear Dr. Schmidt,

I don't write to magazines very often, but I felt I had to comment about Tom Ligon's story "Funnel Hawk" (June 1990). My comments are not intended to be negative, since I enjoyed the story, but I must admit to some reservations about a couple of his ideas. My reservations are based upon personal experience; others might disagree.

The first concerns the design of his airplane for flying around and through thunderstorms. I kind of like his design, since I happen to have a soft spot in my heart for the P-38, and it was one of my favorite airplanes to fly. However, it would not be my first choice to use for investigating thunderstorms. During my days in the Air Corps and USAF I never flew through a tornado and wouldn't consider trying it, but I flew through many, many thunderstorms in various aircraft. To minimize the stress on an aircraft in a thunderstorm, it is wise to reduce speed and not attempt to maintain altitude in an extreme updraft. Reducing power to a level which will still maintain the engine temperature at a reasonable level and increasing the drag will help, but I have frequently been climbing at more than 15,000 fpm with the engines idling and the gear down in a 60,000 pound airplane. Conversely, no amount of power is sufficient to maintain altitude in some downdrafts. Fortunately, downdrafts usually diminish near the surface due to the vertical cycle in the storm. Wind shear is a separate problem and we didn't know what it was when I first encountered it in 1943. It was more luck than good flying that enabled my crew and I to survive my first experience with wind-shear landing at night in a severe thunderstorm.

My personal preference would be a twin turboprop design somewhat smaller than a C-47; not necessarily real fast but very rugged.

My second problem with the story is more subjective. I have reservations about the ability of anyone to become a super fighter pilot with a computer program that has an ordinary display and joystick control. I do not include a sophisticated flight simulator in this comment. I have flown Link trainers, various flight simulators, and was involved in some USAF experiments using analogs of a computer display and relatively simple controls. The simple systems were excellent for learning procedures, but were no substitute for real conditions. I could be wrong, but I believe you really need to experience high gees

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

while swiveling your head and trying to keep track of your opponent(s) during your maneuvers, to acquire the real feeling of a dogfight. Your wing man (if you have one) is there to protect your tail, but he can have problems of his own.

If you were flying a really sophisticated simulator like the Disneyland "Star Tours," which provides an amazing degree of realistic feel, with the added feature of a fully spherical display of the sky, clouds, and the Earth's surface, in which attacking aircraft could be programmed to represent any particular aircraft type(s) with experts at the controls, then, I believe you could indeed become a super pilot, providing you had the inherent ability to begin with.

It should be noted that expert fighter pilots do not necessarily fly by the book; they cross controls, skid, and do whatever is needed to put the plane where they want it. They tend to fly and react by a combination of instinct and training which may not be quantifiable. A simulator, such as the one mentioned above, would be very useful, since top fighter pilots are usually lucky in the beginning; surviving on skill and luck until they learn by experience how to really do their job. Maybe such a simulator exists now, but if so, I am not aware of it.

There are several reasons the P-38 configuration as proposed for the X-WX might not be the best for the purpose intended. While a relatively small aircraft is able to handle the extreme stresses better than larger aircraft, if you are trying to keep the aircraft more or less upright in extreme turbulence while reading various weather instruments, it would be a lot easier with a copilot. Also, the small cockpit wouldn't leave much room for the weather instrumentation; electronics packages are very compact these days but you still need a reasonable amount of panel space for displays and controls. All data could be only monitored at the base, but I suspect the pilot would prefer to interpret much of it real-time.

I do not believe the 400+ mph speed of the proposed design would really be useful; in fact it might be detrimental in extreme updrafts. A really clean airplane tends to increase speed rapidly in strong updrafts, particularly as pilots tend to attempt to maintain altitude, which can be very stressful on the airframe.

In this regard, one of the interesting and potentially fatal characteristics of the P-38 when it attained very high speeds in a dive was a tendency to "tuck under" when you pulled back on the stick. This elevator reversal was the result of the extreme air pressure at the high speed causing the elevator to act like a trim tab, warping the entire horizontal stabilizer angle of incidence. A similar problem was encountered in jets with flexible swept back wings like the B-47; at approximately 0.98M, the aileron controls reversed under some conditions. Very disconcerting to the pilot. Later P-38Ls had spoilers and maneuver flaps which prevented this phenomenon.

The twin boom configuration of the X-WX offers some distinct advantages with the twin engine, on-line pusher prop, but I suspect that graphite composites, while very strong, might be a bit more flexible than stressed skin aluminum, aggravating the control problem under the flying conditions envisioned. This problem could probably be avoided with an appropriate design.

It is also worth noting that the services quit teaching dog fighting after the Korean War, but have reinstated the

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

training in recent years with "Top Gun" type schools.

As I had mentioned, my comments are not intended to denigrate Tom's story. He may or may not be aware of the conditions I have mentioned and is entitled to poetic license. My conclusions are somewhat subjective, representing a combination of proven procedures and personal opinions.

At any rate, I continue to enjoy your magazine after more than 56 years of reading it. I always enjoy your editorials and read them first, perhaps because I tend to agree with your positions most of the time.

PETER G. FRANKLIN
1852 Alpine Drive
San Marison, CA 91108

Dear Dr. Schmidt,

I have to compliment you on your editorial, "The Oldtimer Effect," and I cannot sing the praises of Tom Ligon's story, "Funnel Hawk," loudly enough.

First, the Oldtimer matter. I think you covered it about as thoroughly as possible, except for one thing. One's physical capacity is not always up to enjoying some of the modern novelties. I'll bet "Grandmaw Gatewood" took a lot longer to navigate the Appalachian Trail the second time. Though I spent nearly a year in the Arctic, I have no desire to go there again, as I am more cold-sensitive now. (I missed July through August. Maybe that part of the year would be OK.)

I am wildly curious about Tom Ligon. I have never been in the aircraft or meteorology fields, but I have enough friends in those fields to know that he (though I suspect that Tom is a terrificaly talented female with a nom de plume) didn't get his knowledge in a library as so many of the non-fiction hacks do. I didn't find a technical detail which even tickled my error sense with a feather. If there were any errors, it would take a real insider to catch them.

I think I recognized bits of some acquaintances in the peripheral characters, who are no doubt composites. I am not ashamed to admit that I had tears in my eyes several times as this classical clash of men and machines against nature spun before me. I especially liked the 'skunk works' atmosphere. Bureaucracy can screw up the perfectly obvious.

Finally, if G. Harry Stine's Alternate View wasn't a coincidence of timing, you are a genius for putting it in this issue. I hate to introduce a quibble, but a few of the details on Mr. Stine's article were a bit off. The Merrimac was burned to the water's edge. The iron armor was not a hull but a super-structure. The engines were not added, they were originals replaced in the craft. I nominate as an earlier example the early operation of the Baltimore and Ohio railroad shops under Ross Winans. In a very few years, railroad technology was greatly advanced.

GEORGE F. KIESEL
Saint Louis, MO

The author replies. . . .

Both of these writers sound like people I would like to meet. To Mr. Franklin I offer a trade: a ride in a P-38 for instruction in home computer flight simulators.

While I was overwhelmed by Mr. Kiesel's comments, the story owes a lot to library work and some exciting real-life work by others. Particularly, the inspiration and about 80% of the tornado lore comes from Peter Miller's article "Tornado" in *National Geographic* Vol. 171 No. 6.

The primary design criterion for the X-WX was to have fun with the story. However, in keeping with realism, I

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

wanted a plane which was both far stronger than anything presently available, and with performance which would allow it to check out rapidly changing weather phenomena covering airspace roughly equivalent to a WWII dogfight. The faster plane can be dirtied up nicely with spoilers and speed brakes.

The US Government Thunderstorm Project cited in the story was quite real, and used (among other craft) P-61 Black Widows, which are larger, ugly cousins of the P-38 Lockheed Lightning. I thought the P-61 justified my choice, but must agree with Mr. Franklin's assessment to the extent that even experienced Black Widow thunderstorm investigators frequently couldn't control altitude, sometimes deviating 2,000 feet or more.

Vincent Di Fate followed my drawings faithfully. The front end of the X-WX airframe is not coincidentally similar to the P-38. Aft of the cockpit, everything changes. The booms are thicker, gussetted, and slightly stretched, and the empennage is oversized compared to the original. The graphite composites are not only far stronger than aluminum, they are typically about 4 times as stiff, depending on fiber orientation. Aluminum has a modulus of elasticity of 10.3 Mpsi, while graphite composites typically run in the 40-50 Mpsi range, and individual fibers can have a modulus of 120 Mpsi. I wouldn't want to fly a flat-spinning and comparatively fragile Lightning into a thunderstorm myself, but the X-WX was built for it.

I think Mr. Franklin has a valid point about the instrument panel. The modern fix would be to go with Electronic Flight Information System (EFIS) displays that could be reprogrammed according to the pilot's immediate needs. Another new gizmo which would replace my pre-cessing mechanical gyros and nebulous "electronic orientation device" would be a ring laser gyro (actually an incredibly precise multi-axis Michelson experiment accelerometer). I should have stipulated both.

On to simulators. I am not yet a pilot. I'll defer (enviously) to Mr. Franklin when it comes to flying real fighters. At flying home computers, I'm *good*. I suspect Mr. Franklin would be surprised by just how realistic some home computer simulators are. I never said you could become a crack fighter pilot flying a home computer alone, but they are a powerful, cheap, and safe way to teach some skills, and a great way to light the interest of people wondering if they want to try the real thing. Susan Denton came up with a few wild ideas while flying a PC, but she took aerobatics training and put in 5,000 hours of proficiency time before tackling funnels.

As for this gender thing: curious readers can judge for themselves. Check your Mid-December '85 issue.

TOM LIGON

Dear Stan:

Imagine my surprise when I opened the August 1990 issue, turned to check "The Alternate View" column entitled "Dieting," and discovered that between the galley proofs and the publication, an editorial "correction" had been made in the second paragraph which changed the whole slant of the piece and made it seem a bit absurd.

In the manuscript and the galleys, the second paragraph reads:

Given: All organisms are programmed to grow, but those that exist in an environment where supply exceeds demand must and do go on diets in order to survive.

It was published as:

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Given: All organisms are programmed to grow, but those that exist in an environment where demand exceeds supply must and do go on diets in order to survive.

I meant exactly and precisely what I wrote in the manuscript and proofread in the galleys. In an environment where supply exceeds demand, any organism will consume as much as it can because, as discussed later in the column, it's instinctual. The version as published doesn't make any sense; why would an organism diet if demand exceeds supply? No one is concerned about dieting in Ethiopia.

We're now in a situation in the "post-industrial" cultures of the world, especially in the United States, where supply exceeds demand. This has happened a few times before in history and has been considered to be abberrant. Today, it's a consequence of Herman Kahn's Great Transition best described by Herman himself: "*Two hundred years ago, the human race everywhere was few, poor, and largely at the mercy of the forces of nature; two hundred years hence, barring an unfortunate combination of bad luck and poor management, the human race everywhere will be many, rich, and largely in control of the forces of nature.*"

Which is why (a) learning how to be rich is one of the biggest problem facing us, and (b) learning how to diet is mandatory in such a situation. Not the other way around.

G. HARRY STINE

Sorry about the error, and thanks for the correction. (We don't know how the gremlins got in at that late date!) ■

●I call the points where a rapidly developing technology takes off and starts to displace its predecessor "technological transitions." These are perilous times, but they are the times when great industries are founded. Rarely do leaders of the last technology play a significant role in the next; they've usually become encumbered with a bureaucratic superstructure focused on managing a mature market but incapable of acting on the small scale with the rapid pace that's needed to develop its successor—the new market that's inexorably displacing them. Having grown out of their period of rapid growth, they've forgotten it's possible. They value caution over the very assumption of risk that built their industries in the first place, and through caution, they place at risk everything they have.

John Walker

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

Classified Marketplace

AN FEBRUARY/91

ANALOG/ISAAC ASIMOV combination CLASSIFIED AD rate is $6.50 per word—payable in advance—($97.50 minimum). Capitalized words 40¢ per word additional. To be included in the next issue please send order and remittance to I. M. Bozoki, Classified Ad Manager, DAVIS PUBLICATIONS, INC., 380 Lexington Ave., New York, N.Y. 10017.

ART

NYSHA & EREMON

Introducing A New Series Of Pencil Drawings By

Michael Morrison

Nysha and Eremon is available in a limited edition of 450 signed and numbered copies with 25 Artist's Proofs. The image is reproduced on 18" x 24" stock. $30 per copy; Artist's Proofs $40. Dealer inquiries welcome.

Michael Morrison Studio • 1103 Esters #1609• Irving, Tx 75061• (214) 313-0099

BOOKS & PERIODICALS

100,000 science fiction and mystery paperbacks, magazines, hardcovers. Free catalogs! Pandora's, Box AA-54, Neche, ND 58265.

Bargain Books

Publishers' overstocks, remainders, imports—over 3,000 titles at up to 80% savings in our **FREE CATALOG!** Biography, History, Art, Nature, Gardening, Cooking, Fiction—something for everyone, including about 600 new titles monthly. Write: **Hamilton** Box 15-714, Falls Village CT 06031

OWN a Piece of History from the Golden Age of SF. Rare pulps and Classic First Editions by Bestselling Author L. Ron Hubbard. Write for Free Price List. ASI, 7051 Hollywood Blvd., #400, Hollywood, CA 90028. (800) 624-7907; (800) 624-6504 in California.

BLAST Off for a non-stop Adventure with the Mission Earth Dekalogy by L. Ron Hubbard! The 10 volume New York Times Bestseller now in Paperback. Order Today! $4.95 per volume. Free Shipping. ASI, 7051 Hollywood Blvd., #400, Hollywood, CA 90028. (800) 624-7907; (800) 624-6504 in California.

MISCELLANEOUS

BOOKS, art, videos for S-F, fantasy, horror fans. $1.00 for list. The Dust Jacket, Dept. A/A, 9835 Robin Road, Niles, IL 60648.

TAPES & CASSETTES

OLDTIME RADIO PROGRAMS. Great Science Fiction! Also, mysteries, comedies, westerns. Free catalogue. Carl D. Froelich, Heritage Farm, New Freedom, Pennsylvania 17349.

ARE Voltarian Aliens amongst us? L. Ron Hubbard's Bestselling 10 volume Mission Earth Series, now on Audio Cassette! A Gripping 30 hour multi-cast dramatization complete with sound effects and music. $15.95 per volume, 3 hours each. Free Shipping. ASI, 7051 Hollywood Blvd., #400, Hollywood, CA 90028. (800) 624-7907; (880) 624-6504 in California.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

a calendar of analog upcoming events

1-3 February
Arisia 2 (Boston area SF conference) at Vista International, Waltham, Mass. Guest of Honor—Jack L. Chalker, Fan Guest of Honor—Bob Walker. Registration—$25 until 1 January, $35 thereafter. Info: Arisia 2, Box 2334, Pittsfield MA 01202.

8-10 February
Psurrealcon (Oklahoma SF conference) at Sheraton Hotel, Norman, Okla. Guest of Honor—Mercedes Lackey, Artist Guest of Honor—David Lee Anderson, Editor Guest of Honor—Algis Budrys, Special Guest of Honor—Mark Rogers, Fan Guest of Honor—Donna MacKenzie, TM—Keith Berdak. Registration—$12 in advance, $15 at the door. Info: Psurrealcon, % NOSFA, Oklahoma Memorial Union 215A, Norman OK 73019.

15-17 February
Boskone XXVIII (New England regional SF conference) at the Springfield Marriott and Sheraton Tara, Springfield, Mass. Guest of Honor—Mike Resnick, Official Artist (in memoriam)—Emsh (Ed Emshwiller), Special Guest—Brian Thomsen (Questar Books). Registration—$28 until 11 January, $40 at the door. Info: Boskone XXVIII, Box G, MIT Branch, Cambridge MA 02139-0910. (617)625-2311.

15-18 February
CostumeCon 9 (convention for those interested in SF/fantasy/historical costuming) at Columbia Inn, Baltimore, Md. Registration—$35 until 1 February, $40 thereafter, $20 supporting. Info: CostumeCon9, % Katherine Condon, Box 194, Mt. Airy MD 21771.

28 February-3 March
World Horror Convention at Hyatt Regency, Nashville, Tenn. Guest of Honor—Chelsea Quinn Yarbro, Artist Guest of Honor—Jill Bauman, TMs—Richard Christian Matheson, David Schow, John Skipp, Craig Spector. Registration—$60, limited to 1000 members. Info: World Horror Convention, Box 22817, Nashville TN 37202. (615)385-0917.

29 August-2 September
CHICON V (49th World Science Fiction Convention) at Hyatt Regency, Chicago, Ill. Guest of Honor—Hal Clement, Artist Guest of Honor—Richard Powers, Editor Guest of Honor—Martin H. Greenberg, Fan Guests of Honor—Jon & Joni Stopa. Registration—$95 until 31 December 1990. Supporting—$20 at all times. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Join now and get to nominate and vote for the Hugo Awards and the John W. Campbell Award for Best New Writer. Info: Chicon V, Box 8121, Columbus OH 43221-8121.

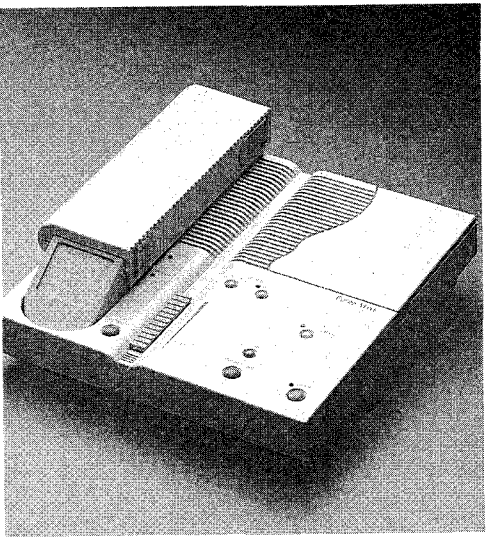
8-14 September
VOLGA-CON (International SF convention on the Volga). Sponsored by SF Club "The Winds of Time" and the Youth Association ATOM. Info: Volga-con, % Boris A. Zavgorodny, Volgograd-66, Poste restante, 400066 USSR. Telephones: 34-74-62, 34-74-64, 34-44-09, 34-86-56.

—Anthony Lewis

Items for the Calendar should be sent to the Editorial Offices six months in advance of the event.

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

► PHONEMATE® 1850



Phonemate® 1850 combines a state of the art answering machine with a handy cordless telephone. The answering machine features remote call screening, message waiting indicator, beeperless remote allowing you to access messages from most touchtone phones with your two digit access number, and the unit even permits household members to leave and receive messages for each other, independent of phone messages. The phone features an automatic digital security code to prevent unauthorized use of your line and a replaceable battery pack and antenna Also—tone/pulse dialing, 9 station autodial, last number redial, mute, flash, and programmable pause. So, stay in touch with Phonemate® 1850. **$219.98** ($7.00) #A1972.

▼ NIGHT TRACKER™

Light up your night! Night Tracker™, the cordless, rechargeable hand-held spotlight packs a 500,000 candlepower beam to give you a light whenever, wherever you need it. The beam is 10 times brighter than your automobile headlights and will carry over 1 mile. Operates on rechargeable batteries or recharge it from 110 volt AC outlet or from any 12 volt car or boat outlet. Perfect for home, travel, boating and camping. Made in the USA and comes with a 90 day warranty. Now featured with amber and red lens attachments. **$79.98** ($6.25) #A1975.

◄ ORANGE MAGIC

Citrus oil is a remarkably powerful cleaning agent though safe, gentle, natural and pleasant to use. Orange Magic levitates the toughest dirt and stains. Just spray it on, wait, rinse, and see dirt vanish. It is the New York Transit Authority's cleaner of choice for combatting graffiti in the subways. Two 16oz. pump bottles for **$15.98** ($4.00) #A1342.

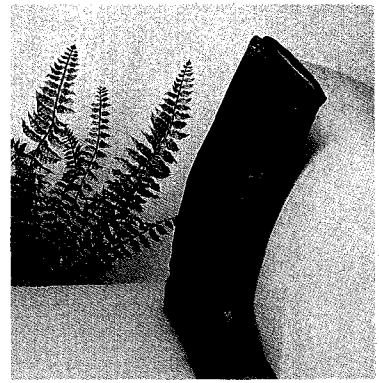
TO ORDER: Send check with item number for total amounts, plus shipping & handling shown in ( ) payable to **MAIL ORDER MALL**, Dept. 021 AN; P.O. Box 3006, Lakewood, N.J. 08701, or call TOLL FREE **1-800-365-8493**. NJ residents add 7% sales tax. We honor MasterCard/Visa. Sorry, no Canadian, foreign, or C.O.D. orders. Satisfaction Guaranteed. 30 day money back guarantee for exchange or refund. Allow 30 days for delivery.

Magalog Marketing Group Inc. © 1990
1905 Swarthmore Ave, Lakewood, N.J. 08701

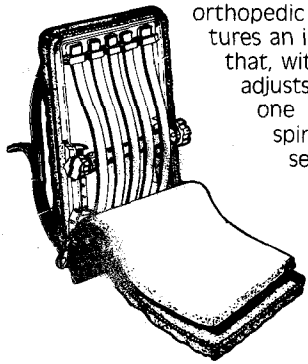
LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED

MAIL ★ ORDER ★ MALL

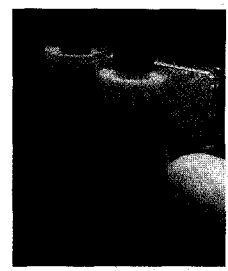
▼ BACK SUPPORT THAT HITS THE SPOT



A soft, cushiony sofa, as inviting as it is to some, can spell agony to a back-pain sufferer. As can office chairs, car, plane or train seats — even ordinary bed-rest pillows. A firm back support is often the answer, but WHY, you ask, does the curve always hit the wrong spot on MY back? This support, developed in cooperation with leading orthopedic physicians, features an internal roller bar that, with a simple twist, adjusts to nine positions, one perfect for your spine! The roller bar serves to shape five vertical ribs of spring steel — for very effective support. More features: comfortable foam padding, durable plastic frame and washable cover, plus convenient side zip to enable roller adjustment, velcro-closed straps for certain chairs and handy carrying tote. Just 2 lbs., 12"x17" — truly a back's best friend. **$34.98** ($6.00) #A1888X.



▼ FOOD FOR WOOD



Most of the convenience waxes you buy actually dry out wood instead of nourishing it. What's the alternative? Our choice is Williamsville Wax. It is made of beeswax and lemon oil, heat-blended with other natural oils. It can be used on any type of wood, any type of finish, on paneling or kitchen cabinets as well as fine furniture. Williamsville Wax is super for restoring neglected or mistreated wood. Two 8-oz. bottles cost **$13.98** ($3.25) #A1968.

CALL TOLL FREE 24 HRS. 7 DAYS 1-800-365-8493

TO ORDER: Send check with item number for total amounts, plus shipping & handling shown in ( ) payable to **MAIL ORDER MALL**, Dept. 021 AN; P.O. Box 3006, Lakewood, N.J. 08701, or call TOLL FREE **1-800-365-8493**. NJ residents add 7% sales tax. We honor MasterCard/Visa. Sorry, no Canadian, foreign, or C.O.D. orders. Satisfaction Guaranteed. 30 day money back guarantee for exchange or refund.

Magalog Marketing Group Inc. © 1990

1905 Swarthmore Ave., Lakewood, N.J. 08701

LICENSED TO UNZ.ORG
ELECTRONIC REPRODUCTION PROHIBITED